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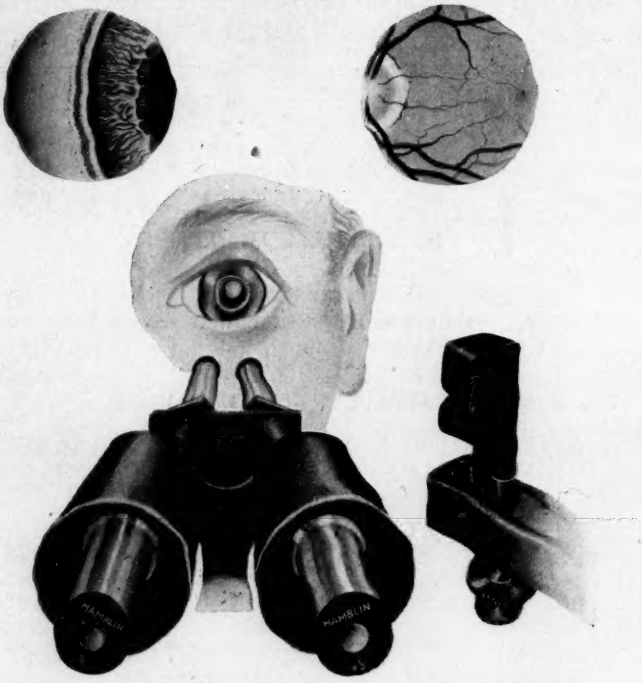

The Sarwar Diagnostic Contact Lens described in the October issue of the *British Journal of Ophthalmology*, enables the owner of a conventional slit-lamp to make a detailed binocular examination of the vitreous, fundus and the angle of the anterior chamber. No deviating prism or other special equipment is required.

Brit. J. Ophthal. (1954) 38, 705.

COMMUNICATIONS

MAGNETIC INTRA-OCULAR IMPLANT*

NEW SURGERY OF THE IMPLANT—THE MAGNETIC ARTIFICIAL EYE

BY

J. HORTON YOUNG

Nottingham and Midland Eye Infirmary

And all their desire is in the work of their craft.—*Ecclesiasticus, xxxviii.*

THE advent of this new intra-ocular implant ushers in a novel method of motivating artificial eyes. The magnetic implant is of the "all-buried" type. Owing to the safety factor incorporated in the design of the implant some limitation has been placed upon the types of globes in which it can be employed (*vide infra*, Mode of Use), and this in turn has made the surgical approach a sterner task. The essence of all this, however, is that this, the first intra-ocular magnetic implant,† would provide a satisfactory cosmetic correction of a permanent nature. The prosthesis is also magnetically activated.

Description

(A) Magnetic Implant.—The implant body consists of a solid mass of "non-free monomer" acrylic resin with a squared opening at either end; the anterior aspect is flat while the posterior end is rounded, the main body itself not being quite cylindrical in form. The anterior cup is that in which the peg of the magnetic prosthesis will ultimately rest so that the complementary magnet within the body of the peg of the artificial eye will be in close apposition with the magnet of the implant, seated immediately beneath the floor of the anterior cup of the implant. The posterior squared recess holds the curved manipulative key for use during surgical operative procedure (Fig. 1*a* and *b*).

Fig. 1(*a*).—Magnetic implant from superior aspect, showing anterior ostea, "magnetic cup", and posterior squared recess.

Fig. 1(*b*).—Anterior view of magnetic implant, showing oblong "magnetic cup" with gold-plated magnets beneath floor of cup.

Within the body of the implant are placed two powerful aluminium nickel cobalt bar magnets, the two north and the two south poles having been coupled together in a counter-attractive manner to increase the magnetic attraction. These magnets

*Received for publication March 22, 1954.

†The implant is manufactured by Messrs. C. and L. E. Attenborough, Ltd., George Street, Nottingham.

lie beneath the floor of the anterior cup; they are gold plated and covered by an acrylic substance, being thus insulated against erosion from tissue structures and fluids.

The length of the implant body is 12 mm., the height 12 mm., and the width 14 mm. The *floor* of the anterior cup has an area of 11 × 8 sq. mm., and the overall *depth* of the cup is 4 mm. The width of the superior and inferior walls is 11 mm.; that of the lateral and medial walls being 8 mm. The medial side of the implant is that to which the *south pole* on the magnet points, the implant being inserted within the globe with its long axis in the horizontal meridian. The thickness of the lip of the cup is approx. 1·5–2 mm. throughout. Around the body of the cup is an equatorial groove indicating the point of exit of the four canaliculi which perforate the substance of the implant. The canal entrances are at the four " corners " of the floor of the anterior cup (Fig. 1*a*); their position has been specially chosen so that when the operation commences no difficulty will be found in inserting the sutures. These canals are capable of taking a Jameson needle, doubly threaded with tantalum wire and a nylon suture.

The manipulative key previously mentioned is S-shaped. It is so designed that, while fitting into the base of the implant, it still bends forward anteriorly to curve round the bony upper margin of the orbit (Fig. 2).

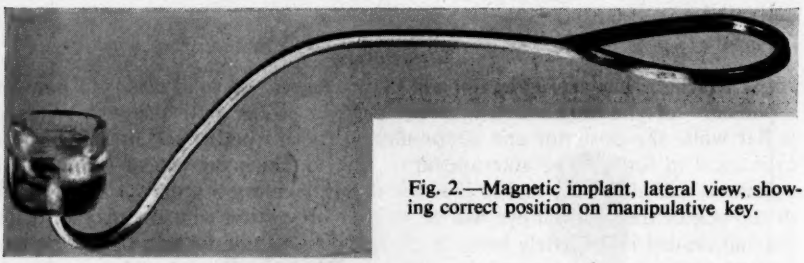

Fig. 2.—Magnetic implant, lateral view, showing correct position on manipulative key.

(B) Magnetic Prosthesis.—This will be found to be a prosthesis of the semi-shell type with a peg back, in which are inset the complementary aluminium nickel cobalt magnets. The shell principle has been found desirable because the new fornices created by the inclusion of the implant within the globe are wider than usual and extend back posteriorly around the circumference of the implant in the form of a para-implant sulcus (Figs 3*a*, 3*b*, 4*a*, 4*b*).

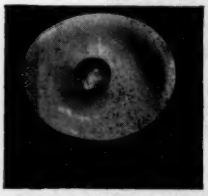

Fig. 3(*a*).—Posterior view of magnetic artificial eye showing semi-shell nature of prosthesis with central peg enclosing magnet.

Fig. 3(*b*).—Depth of peg in relation to cornea and curvature of prosthesis.

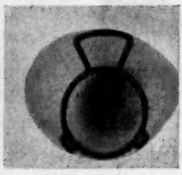

Fig. 4(*a*).—Magnetic artificial eye with foreign body protractor on cornea. Note acentral position of peg.

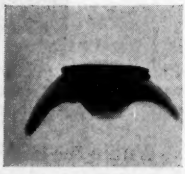

Fig. 4(*b*).—Peg with enclosed magnet extending posteriorly beyond posterior limits of ciliary body in normal globe.

Mode of Use of Magnetic Implant

The present magnetic implant is an attempt to design an implant which is completely reliable in every sense of the word. This is a formidable task since the stages of development of implants, in general, have not yet reached a perfection which will enable them to be used universally.

With the tremendous advances in ocular therapeutics, contact lens technique, and surgical applications, many more eyes are being saved annually than ever before. Consequently implant surgery is becoming less necessary but *more specialized*, as improvements in design and surgery point the way to a more exact method of solving these problems.

In step with these ideas has been the development of the magnetic implant, which has been designed for a limited and specialized application. This new implant is to be used only in those globes in which the section anterior to the anterior attachments of the extrinsic recti muscles is reasonably intact. Such cases would include :

(1) Unresolved primary glaucoma.

(2) Unresolved secondary glaucoma.

(3) Degeneration consequent on birth injury.

(4) Recent traumatic perforation, provided this has destroyed the globe, either by perforation by way of the lid substance, or by perforation through the palpebral aperture into the posterior section of the globe.

(5) Phthisis bulbi.

(6) Old traumatic perforation, provided it conforms to the pathological pattern mentioned above. An exception would be a blind eye, with uncontrolled tension from spontaneous haemorrhage or other complication, provided that any foreign body had been removed at the time of the original injury.

(7) *Absolute* blindness from any cause after injury from acids, alkalis, or other industrial reagents, exceptions being globes which would take a suitable cosmetic contact lens.

(8) Gross congenital malformation of the globe necessitating cosmetic correction.

Preparation

Table

(1) All instruments for evisceration.
(2) All instruments for enucleation.
(3) Magnetic implant.
(4) Implant manipulative key.
(5) Four Jameson needles, two doubly threaded with tantalum wire and nylon and two unthreaded.
(6) Other nylon sutures.
(7) Absolute alcohol.
(8) Methylene blue plus marker and sterile blotting paper.
(9) Roll of tantalum wire, fine.
(10) 2-mm. trephine.
(11) Surgical operating gloves.
(12) Special " fish-hook " needles (emergency measure).
(13) Small bar magnet appropriately stamped " N " and " S ".

Anaesthesia

(1) General anaesthesia and local retrobulbar injection of novocaine 4 per cent. and adrenaline 1/40,000,

or

(2) Retrobulbar anaesthesia using same solution combined with cocainization of conjunctival sac.

For the retrobulbar injection, 4 ml. "Novutox" should be injected well posteriorly, to produce physiological proptosis of the globe and render the posterior segment more accessible for sclerotomy and the introduction of the magnetic implant.

Pre-Operative Precautions

(1) Unsuitable subjects:

(*a*) Patients of a highly nervous or neurotic nature.

(*b*) Patients who suffer from angioneurotic oedema, marked allergic diathesis, dermographia, or giant urticaria.

(*c*) Patients with exophthalmos are unsuitable owing to the increasing deposition of orbital fat and its continuing encroachment upon and infiltration of all tissues.

(*d*) Patients who normally have a lowered resistance to infection from any general cause, such as diabetes or pulmonary phthisis.

(2) Adequate pre-medication if the operation is to be performed under local anaesthetic.

(3) Prophylactic, antibiotic, and chemotherapy instituted 2 days before the operation; the antibiotic therapy is carried on for a further 6 days, and the chemotherapy for 14 days.

(4) The globe in which the implant is to be inserted must have a complete scleral casing as far back as the insertion of the recti muscles.

(5) Allergy to acrylic resin, penicillin, and the chemotherapeutic agent used in pre-operative medication must be excluded.

(6) Where older children are concerned it is most important to exclude chronic infection in the ear, nose, or throat, and impetigenous lesions on the skin. Swabbing for diphtheritic infection should be routine in all child patients. The implant is not suitable for younger children.

(7) Short-wave diathermy should be available for deep heat therapy post-operatively.

Surgical Technique

Preliminary Remarks.—As this operation involves procedure first on a firm globe, and later on on a collapsed globe, some stages of the operation are best performed before trephining, posterior sclerotomy, and evisceration soften the globe.

Firstly, with a firm globe, the corneal marking with methylene blue to indicate the ultimate sites for the insertion of the implant-holding sutures is facilitated.

Secondly, the conjunctival and episcleral implant-covering sutures may be inserted before the trephine is done. It should be noted, however, that these sutures can also be inserted later on, since the use of the implant manipulative key enables the implant to be held firmly against the cornea while the sutures are being inserted. To delay putting these sutures in until the stage when the implant is in position and held by its own holding sutures may invite disaster, since it may be impossible to cover the cup adequately in the correct manner,

even with small corneal needles or the use of " fish-hook " needles, through the walls of the cup interfering with the insertion of needles and embarrassing the full action of the needle holder. This would then result in faulty implant covering, exposure of the wires and sutures, and the conversion of the completely buried magnetic implant into a partially buried one.

Thirdly, the paracorneal implant suture must be inserted early so that it is accurately placed in relation to the corneal limbus and the anterior attachments of the extrinsic recti muscles. *At the same time the DEPTH to which the suture is inserted is easily controlled*, the globe not being perforated at the various points of attachment of the suture. This suture is so important that it is discussed more fully below.

Trephining the globe before sclerotomy and evisceration facilitates more difficult operative procedure later.

Paracorneal Implant Suture.—To understand clearly the nature of the suture and its significance in the operative technique, an analysis of the anterior section of the globe to be invaginated into the implant cup must be undertaken.

It will be seen that the cornea alone will not cover the total area of the implant cup, and that sclera will be needed in addition if the cup is to be adequately covered. For this reason the accurate measurement of the internal diameters of the cup in at least two principal meridians is necessary if the corresponding corneo-scleral area to fill the cup is to be mapped out by the suture which, when contracted and tied, invaginates the contained area of sclera and cornea into the implant cup, so covering it.

The principal meridians are very simply calculated, remembering from the description of the implant that the floor is 11 × 8 mm. in area, upper and lower walls 11 × 4 mm., side walls 8 × 4 mm., and thickness of walls 1·5 mm. all round.

Principal horizontal meridian 1·5 + 4·0 + 11·0 + 4·0 + 1·5 mm.	22 mm.
Vertical meridian 1·5 + 4·0 + 8·0 + 4·0 + 1·5 mm. ...	19 mm.
Total area	22 × 19 sq. mm.

Knowing that the corneal diameter is 11·5 mm., the actual distance of the stitch from the limbus above, below, and from the side-to-side areas can be calculated.

The paracorneal suture is therefore roughly oblong in outline when inserted in the sclera.

As some corneae are larger than others, the method of working out the distance of the suture in relation to the circular cornea is given below:

The difference in the width of the cornea and limits of the paracorneal suture, horizontally, is 22 − 11·5 mm. = 10·5 or 11 mm. The distance on each side of the cornea to which the suture should extend is 5·5 mm. Similarly, in the vertical meridian, the distance is 4 mm. above and below.

If the calculation is based on the positions of the anterior attachments of the extrinsic ocular muscles, the appropriate distances from each muscle, starting from the medial rectus, are as follows:

Internal rectus muscle to limbus	5·5 mm.	Suture at attachment.
Inferior rectus muscle to limbus	6·5 mm.	2·5 mm. from attachment.
Lateral rectus muscle to limbus	7 mm.	2 mm. from attachment.
Superior rectus muscle to limbus	7·75 mm.	3·5 mm. from attachment.

Surgical Anatomy.—It is well to consider the surgical anatomy of the part in question before undertaking the new surgery of the magnetic implant

operation. For this reason detailed references to the anatomical structure of the orbit and the globe are mentioned hereunder. Careful reference to the pictures will show the position of the principal intra-orbital structures in relation to the area of operation. All the pages and figures quoted in the following paragraphs are from Duke-Elder (1932).

Figs 232 and 233 (p. 166) illustrating frontal sections through the right orbit near the eyeball, and through the posterior part of the orbit respectively, show that the only clear entrance to the posterior globe is between the superior and lateral recti muscles. It will also be noted, in that section near the eyeball, that the supra-orbital artery lies under cover of the superior rectus and of the levator palpebrae superioris, while the frontal nerve lies above it. As the posterior orbit is not invaded further than the posterior aspect of the globe at operation, these structures are quite safe if the operative technique is strictly adhered to.

Figs 234 and 235 (pp. 167 and 168) show how the oblique muscles are avoided in the incision. Examination will also demonstrate clearly how the forward movement of the globe, by means of physiological proptosis, renders the posterior aspect of the globe more accessible for surgical intervention.

Fig. 237 (p. 170) illustrates the relation of the blood vessels and nerves as they leave or enter the orbit to the apex of the bony pyramid and the optic nerve. These structures take an oblique course and lie well away from the area of operation in their course through the orbit.

Fig. 254 (p. 178) illustrates the bend in the optic nerve which allows the globe to move forward (being straightened out) after retrobulbar injection; the same diagram also shows the relation of the equator of the globe to the bony orbital margin.

The important nerves and vessels are very beautifully illustrated in Fig. 257 (p. 183), and Figs 262 and 263, (pp. 190 and 191).

It has been shown that the supero-lateral area of the globe offers the only really safe approach to the posterior of the globe, for, as the ophthalmic artery goes forward into the orbit, the principal branches will be seen to diverge in various directions away from the site of election of operation. The ophthalmic artery wends its way anteriorly to the medial side of the orbit to lie below the superior oblique muscle (actually between it and the medial rectus), while the supra-orbital artery goes forward beneath the roof of the orbit, lying between it and the levator palpebrae superioris, to emerge at the supra-orbital notch anteriorly.

The lacrimal artery runs along the lateral orbital wall along the upper margin of the lateral rectus to the lacrimal gland. The posterior ciliary arteries will be seen to pierce the globe around the optic nerve. *It is important, therefore, with the posterior sclerotomy incision, not to penetrate as far posteriorly as the ciliary arteries.* It may be thought that this is virtually impossible, seeing how far they are placed posteriorly in the orbit, taking into account all the essential structures which lie between them and the anterior aspect of the orbit, but, with the surgical technique advised, it is quite an easy matter to reach to the posterior ciliary arteries. Dissection, therefore, in the more posterior aspect of the globe should be very carefully done. The veins, of course, appear to be more numerous and are not so strategically placed, but it is remarkable how free the whole operation is from haemorrhage of any kind. The retrobulbar injection of novocaine and adrenaline is of great assistance in this respect.

The principal orbital nerves (the frontal and lacrimal nerves) follow roughly the course of the arteries (Fig. 262, p. 190).

Surgery of the Intra-Ocular Magnetic Implant Mark I

(A) The Intact Globe

Stage 1.—4 to 5 ml. "Novutox" 4 per cent. is injected slowly into

the most posterior part of the orbit. The conjunctiva is anaesthetized by the instillation of a few drops of 4 per cent. cocaine hydrochloride. After a few minutes the full effect (proptosis) of the retrobulbar injection becomes manifest.

Stage 2.—The conjunctiva is dissected up around the limbus of the cornea, and, with blunt scissors, it is dissected up widely posterior to the anterior attachments of the extrinsic muscles.

Stage 3.—The globe is exposed by incising the conjunctiva at the free limbal edge in its upper outer segment, so that with the episclera and Tenon's capsule they are incised almost to the posterior limits of the globe above and to the outer side. *The intactness of all muscles is checked by means of a muscle hook.* A conjunctival suture is placed on either side of the incision so that this section of the conjunctiva can be accurately re-sutured later, when the conjunctiva is being reconstituted for the purpose of covering the implant cup (Fig. 5*a*).

Stage 4.—The above manoeuvre is repeated in the lower outer quadrant but not exposing the sclera so far back. The trephining of the globe which will be done in this segment later needs to be performed slightly anterior to the equator of the globe (Fig. 5*a*).

Stage 5.—The corneal epithelium is removed mechanically or with absolute alcohol (Fig. 5*b*).

Stage 6.—The insoluble paracorneal implant suture is inserted as recommended above under "preliminary remarks" (Fig. 5*b*).

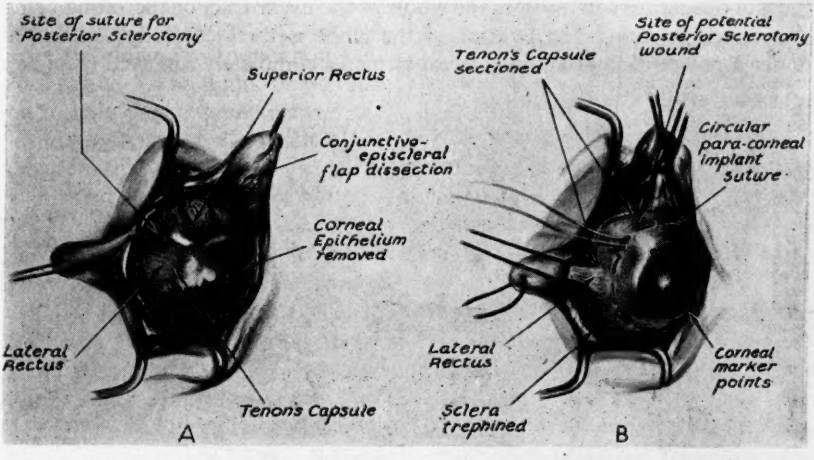

Fig. 5(*a*).—Limbal conjunctiva and episclera dissected up from anterior globe. Epithelium of cornea removed. Tenon's capsule still intact.

Fig. 5(*b*).—Paracorneal circular implant suture in position. Methylene blue corneal marker points seen. Posterior sclera exposed for trephining and posterior sclerotomy. Note potential site of sclerotomy. Globe trephined.

Remember that this suture, after insertion, has a single tie placed in it, and is tightened slightly. In no circumstances is the sclera to be perforated when suturing, as this may cause a serious reduction in tension of the globe.

Stage 7.—Using the magnetic implant as a marker guide, four points are marked with methylene blue on the anterior surface of the cornea, corresponding to the position of the anterior ostea of the implant suture canals. The two superior marks should be 11 mm. apart, and the two inferior marks should be 11 mm. apart. These upper and lower marks on the medial and lateral sides of the cornea should be at a corneal distance of 8 mm. (Fig. 5*b*).

These marks are renewed from time to time if they show signs of becoming obliterated during the course of the operation.

Stage 8.—The globe is trephined at the site of election with a 2-mm. trephine.

(B) The Collapsed Globe

Stage 9.—A long oblique posterior sclerotomy is now made, commencing with a Graefe incision slightly posterior to the anterior attachments of the external rectus muscles at about 2 o'clock, running slightly obliquely posteriorly to the back of the globe. The wound can be enlarged with blunt-tipped scissors as required (Fig. 5*c*).

Stage 10.—The globe is now eviscerated in a systematic order through the posterior sclerotomy wound, starting with the separation of the ciliary body and working backwards to the posterior fundus. This can be neatly achieved by using an iris repositor and bending it to the required shape for the purpose. Careful dissection will result in the whole of the uveal tract of the retina being eviscerated *in toto*. The interior of the globe is then carefully scrutinized under a powerful light and any uveal elements completely removed (Fig. 5*c*).

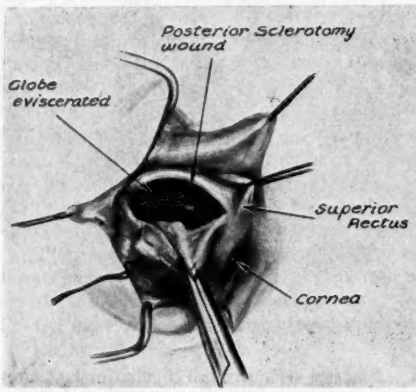

Fig. 5(*c*).—Posterior sclerotomy done. Globe eviscerated and rotated medially for introduction of magnetic implant.

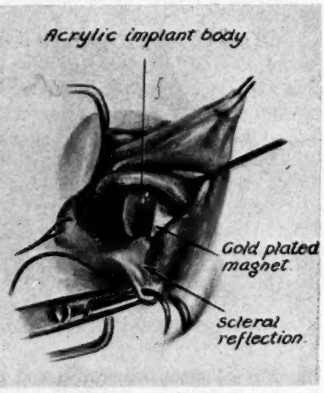

Fig. 5(*d*).—Implant in position with manipulative key temporarily removed.

Stage 11.—With a small bar magnet, the *north pole* pointing towards the implant, the polarity of the magnets of the implant are checked, so that when it is inserted in the globe, the south pole of the implant magnets will be pointing to the medial side. The manipulative key is placed in the posterior recess of the implant in the correct manner, *i.e.* so that the south pole is medial when key is held vertically.

Stage 12.—The implant is now ready for insertion into the scleral cavity through the posterior sclerotomy wound. This ensures that the wound is of the correct size and that there will be no hindrance to the further operative procedure (Fig. 5*d*).

Stage 13.—The key is manipulated so that the implant is pressed up against the cornea (Fig. 5*e*). This gives sufficient backing to the cornea for inserting these sutures which will ultimately bind the covering conjunctiva and the cornea together, so causing the implant to become completely buried. Four of these conjunctival implant-cup-covering sutures, black silk and doubly armed, are inserted into the cornea just below and above the superior and the inferior methylene blue marker points respectively. When the conjunctiva is then brought over the " magnetic cup ", the conjunctiva can be duplicated over the whole of the cup area by bringing the upper conjunctiva to the lower limits of the cup and the lower conjunctiva to the upper limits of the cup, both layers of the conjunctiva being pierced by the doubly-armed needles, the sutures being tied to hold them in place. *This latter operative manoeuvre, however, is delayed until Stage 27, as the surgical procedure now involves the difficult problem of inserting the implant-holding sutures and wires and the nylon posterior sclerotomy-limiting sutures.*

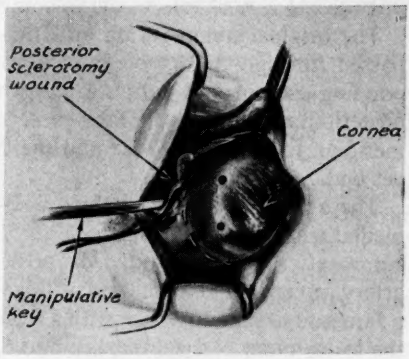

Fig. 5(*e*).—Cornea pushed forwards by use of manipulative key on posterior aspect of implant, showing complete operative control of implant for all suturing purposed. Key in penultimate position.

Stage 14.—It is perhaps best to insert the nylon sclerotomy-limiting sutures first, one at each end of the incision. These can be cut long and used as retractors if necessary. They are particularly useful when the wound is finally sutured.

Stage 15.—The globe is now almost ready for the insertion of the implant-holding sutures, but so that there is not too much strain on these the paracorneal implant suture is now tightened in order to cause the cornea and the anterior sclera to invaginate *partly* into the implant cup. *The paracorneal suture is not yet ready for final tying.*

Stages 16, 17, and 18.—It will be seen that two of the Jameson needles (or their equivalent) are doubly threaded with an insoluble nylon suture and a tantalum wire. There is only one needle on these sutures at first. The corneal site of penetration for the first needle and suture is the upper and inner quadrant. With the implant held by the manipulative key in the correct position, the needle is passed through the upper inner methylene blue marker on the cornea into the implant cup. The point of the needle is then moved gently across the floor of the cup until it strikes the corresponding osteum of the implant suture canal, when it is passed through the implant body and finally out through the posterior sclera, where the needle is removed and the free ends are clamped separately.

The *free end* of this *nylon suture is now threaded on to another Jameson needle and to a fresh piece of tantalum wire,* which wire is itself already threaded to a Jameson needle in combination with a further nylon suture.

The original nylon suture and the new piece of tantalum wire are then passed through the lower inner marker on the cornea, through the corresponding osteum and suture canal of the implant body, and so through the posterior sclera below. This piece of nylon is then lying in the vertical meridian to the medial side and the two ends are clamped together but not yet tied.

There are now two tantalum wires both penetrating the cornea on the medial side above and below (Fig. 5*f*). The free end of the tantalum wire below, after passing through the posterior sclera, should be clamped with an artery forceps. The other end of this wire (which is already threaded through a Jameson needle, together with a fresh piece of nylon) is then passed through the lower outer corneal marker into the implant cup through the corresponding osteum and suture canal of the implant, and so through the posterior sclera as before. The ends of the nylon suture and the tantalum wire, after emerging from the posterior sclera, are clamped to prevent their slipping through the cornea again.

We now have one free end of a tantalum wire and one free end of nylon suture left. These are threaded on to a fresh Jameson needle, and this doubly-threaded needle is passed in a similar manner through the remaining upper outer corneal marker point into the implant cup and so through the body of the implant and the posterior sclera. The two ends of the tantalum wire above are then clamped together, and the two below are similarly dealt with. The outer nylon ends are also clamped.

Stage 19.—The nylon sutures are now tied permanently on either side (Fig. 5*f* and *g*).

Stage 20.—A permanent tie is now placed in the paracorneal implant suture, seeing that the sclera has been brought well forward and that the cornea and sclera have been thoroughly invaginated into the implant cup. This suture takes the strain off the implant-holding wires and sutures. The stage is now set for the final step of tying the corneal limbus tantalum wires above and below (Fig. 5*f*).

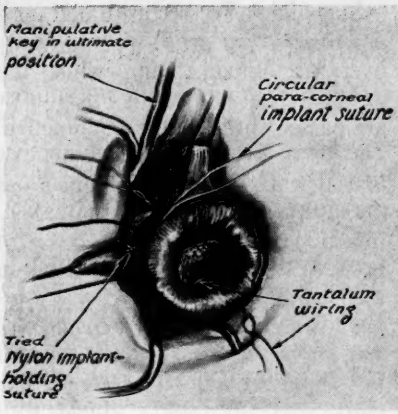

Fig. 5(*f*). — Manipulative key in ultimate (correct) position for inserting dual implant-holding nylon sutures and tantalum wires. Corneo-conjunctival sutures omitted for pictorial purposes.

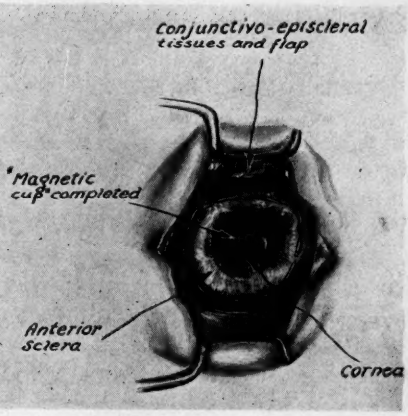

Fig. 5(*g*).—Cornea and sclera sutured into "magnetic cup". Paracorneal implant suture tied and cut short. Nylon implant-holding sutures tied and cut short. Tantalum wires twisted, cut short, and bent back posteriorly on sclera.

Stage 21.—The tantalum wires are twined together firmly, cut short, and the free ends turned back to lie on the posterior globe, avoiding the superior and inferior recti. It may be found expedient to pass the wire under the anterior attachment of the recti if the sutures have been inserted sufficiently posteriorly on the globe. Keep twined ends away from muscle in tying (Fig. 5*g*).

Stage 22.—Now that the difficult section of the operation has been finished it only remains to remove the manipulative key by easing it gently from the posterior section of the globe by means of an artery forceps.

Stage 23.—The whole of the interior of the globe and the retained implant must now be atomized with sulphathiazole and penicillin powder.

Stage 24.—The sclerotomy wound is now closed, using the nylon limiting-sutures as retractors. The wound should be sewn up with interrupted nylon sutures closely placed, *commencing posteriorly and working forwards*, seeing that a sufficiently wide section of the sclera on either side of the wound is taken up in the sutures. This helps to limit the space available within the globe, and at the same time, by taking plenty of sclera, there is less chance of the sutures cutting out (Fig. 5*g*).

Stage 25.—All the raw areas in relation to the posterior sclerotomy wound are atomized with sulphathiazole and penicillin powder, before suturing them with an absorbable suture.

Stage 26.—Tenon's capsule, the episcleral tissues, and the conjunctiva are reconstituted so that the free edge of the conjunctival limbal ring has been re-made.

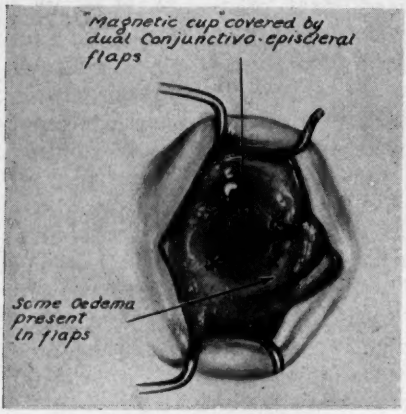

Fig. 5(*h*).—Conjunctivo-episcleral flaps reconstituted and brought over whole globe and "magnetic cup" as dual overlapping flaps. Suturing appears wide, flaps being somewhat cedematous.

Stage 27.—The reconstituted conjunctiva is then gently drawn down over the implant cup, while the doubly-armed atraumatic silk sutures are passed through the conjunctiva. The lower section of the conjunctiva is dealt with in a similar manner and the sutures are then tied. In this way infection is less likely to creep in between the layers of conjunctiva in the healing stage, since *the lower conjunctiva overrides the upper conjunctiva and thus brings the raw edge towards the upper section of the cornea and away from the lower conjunctival fornix* (Fig. 5*h*).

Stage 28.—The whole of the contents of the socket is re-atomized with penicillin and sulphathiazole powder.

Stage 29.—A simple penicillin "tulle gras" dressing is applied*

Stage 30.—A firm pad and binder are now applied and left in position for at least 5 days without renewal.

Post-Operative Treatment

The patient should rest in bed for at least 10 days after operation, although on the seventh day he may go to the toilet. Sedatives should be employed.

The orbital reaction may be severe if the patient is allowed too much liberty (Fig. 6*a*).

The pressure bandage should be renewed quickly on the fifth day so as

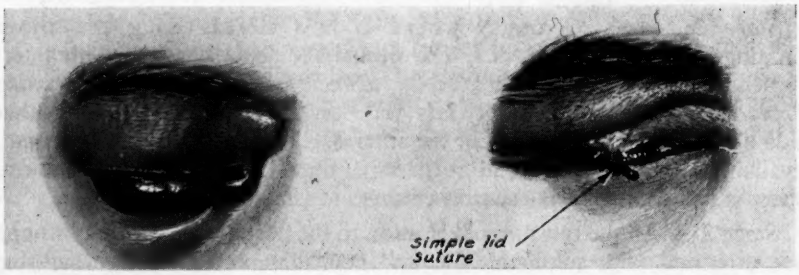

Fig. 6(*a*).—Seventh day. Dependent oedematous conjunctiva extruding from lids. This safety measure relieves tension in external tissues.

Fig. 6(*b*).—Sixteenth day. Receding dependent conjunctiva rotated under upper lid. Lids held together with a simple suture.

* Under no circumstances do a tarsorraphy or suture the lids together. There must be room for swelling of the conjunctiva as a kind of release mechanism so as to prevent any of the implant-holding sutures from cutting out.

to limit conjunctival dependent oedema. Repeat the tulle gras penicillin dressing. DO NOT use a dry dressing.

On the eighth day the patient may be taken to the short-wave diathermy in a chair.

As conjunctival oedema begins to recede, the skin over the lids begins to wrinkle, indicating that there will soon be a " socket space " forming underneath the lids of sufficient capacity to " swallow " any dependent conjunctiva. This is achieved by rolling the swollen conjunctiva under the upper lid and suturing the lids together. *DO NOT do a tarsorraphy with lid union* (Fig. 6*b*).

Continue short-wave diathermy. After some days the suture may be removed from the lids. The conjunctival swelling having subsided, the magnetic implant cup lined with conjunctiva will be seen. Remove sutures.

From the 14th day *x* rays may be taken to see the movement of the globe, with the contained magnetic implant, by observing the positions of the radiographic opacities caused by the magnets and tantalum-holding wires.

From the appearance of the cup, and the movements a decision to insert a shell may be taken, but it is quite unnecessary.

When the conjunctiva shows no sign of prolapsing through the palpebral fissure (Fig. 6*c*), a dry dressing may be employed to prevent undue softening of the skin of the lids.

During this healing phase keep the lids closed and the conjunctival fornices filled with penicillin G ointment.

When clinical evidence shows that active swelling has subsided, short-wave diathermy may be stopped. Sometimes it may be necessary to continue once a week to help in absorbing deep orbital swelling.

After about 2 months a magnetic prosthesis may be made.

After insertion the prosthesis should be removed about every 4 weeks, with all due regard to cleanliness.

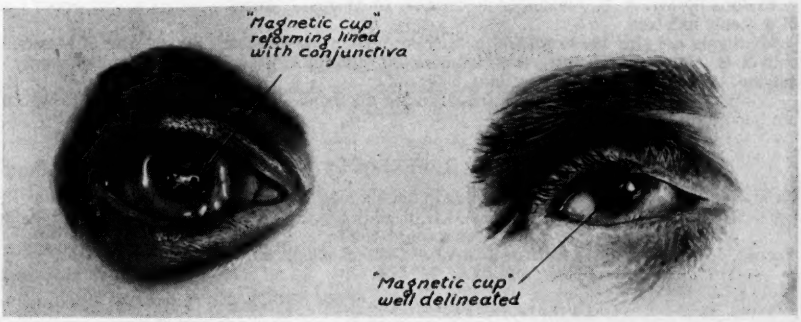

Fig. 6(*c*).—Conjunctival swelling receding. Small adventitious adhesion of conjunctiva above and above and below cut, exposing excavation of " magnetic cup ".

Fig. 6(*d*).—" Magnetic cup" fully formed. Note that it has taken the form of the prosthesis peg and is almost round. Prosthesis peg rests on reactive subconjunctival fibrotic cushion.

Special Note.—If the paracorneal implant suture has been inserted sufficiently wide, the implant cup will be fully seen (Fig. 6 *c* and *d*), otherwise some of the cup space will be encroached by that suture, with the necessity of modifying and scaling down the magnetic prosthetic peg accordingly.

End Results

The end results of this major surgical procedure are most satisfying cosmetically. The patient also derives great benefit in other ways, since he is enabled to join in sports and games without the prosthesis tumbling from its socket. Moreover he is also enabled to work in difficult postural positions without prosthetic anxiety. Owing to the splendid fitting, the palpebrae have a more natural look. The prosthesis need only be removed about once every month, and in this way the lysozyme of the tears is enabled to cope more readily with any infection which may enter or be introduced into the socket.

Summary

Details of a new intra-ocular magnetic implant and prosthesis are given. The mode of use of the implant is outlined. The surgical operative procedure is described in full detail. Post-operative management is discussed. A series of photographs of the magnetic implant and prosthesis and detailed sketches of the actual implant operation are included.

I should like to thank the Area Management Committees of both the General Hospital and the Nottingham and Midland Eye Infirmary, under the aegis of the Sheffield Regional Hospital Board, for permission to reproduce the various *x* rays and photographs.

I am indebted to the President and the Committee of the Midland Ophthalmological Society for their kindness in permitting me to show this new magnetic artificial eye at the combined Presidential and Coronation Meeting of the Society at the Nottingham and Midland Eye Infirmary in June, 1953.

My thanks are due to Dr. W. J. Mowat, and Dr. F. M. Gordon, radiologists at the General Hospital, Nottingham, for their kindness in taking the *x* ray photographs, to Mr. McLeod for the photographic reproduction of these *x* rays and for the coloured photographs of the actual operation upon which Figs 5 and 6 are based. The very clear and elegant black and white sketches were done by Mr. A. E. Alexander by courtesy of Messrs. Clement Clarke Ltd., to whom I am also deeply indebted.

My thanks are also due to Mr. John Attenborough, of the Research Department of Messrs. C. and L. E. Attenborough Ltd., who manufactured the implant and arranged for the supply of magnets of varying types and strengths.

The making of the magnetic prosthesis was in the hands of Mr. Steer Wardman, to whom I am greatly obliged for its perfection.

REFERENCES

DUKE-ELDER, S. (1932). "Text-book of Ophthalmology", vol. 1, Figs 232 and 233, p. 166; Fig. 234, p. 167; Fig. 235, p. 168; Fig. 237, p. 170; Fig. 254, p. 178; Fig. 257, p. 183; Fig. 262, p. 190; and Fig. 263, p. 191. Kimpton, London.

YOUNG, J. HORTON (1951). *British Journal of Ophthalmology*, **35**, 623.

——— (1952). *Trans. ophthal. Soc. U.K.*, **72**, 589.

Brit. J. Ophthal. (1954), **38**, 719.

BACTERIOLOGY OF THE HEALTHY CONJUNCTIVA*

BY

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THE normal bacterial flora of the mucous membranes of the human body have been described for many years and the nature of the common inhabitants is well established; the bacteriological findings in the healthy conjunctiva have been critically surveyed by Duke-Elder (1938). These latter results were obtained in the decades before the use of modern chemotherapeutic drugs for ocular infections became widespread, and it is important to know in what way, if any, such treatment is influencing the commensal organisms of the eye. It has been postulated that the selection pressure due to the use of antibiotics will favour the replacement of bacteria sensitive to these drugs, by strains or mutants which have become, or are, drug-resistant. Recent reports by Gibson (1951) and Barfoed (1953) suggest that these changes may be occurring.

In order to determine whether similar changes were happening in London, a survey of the bacterial flora found in 5,000 persons who were admitted for clean surgical procedures was undertaken. From such data it was hoped to determine which single antibiotic, or combination of antibiotics, was most likely to be of use in the pre-operative sterilization of the conjunctiva. Since most of the cultures reported below were taken during the years 1950-51, they do not reflect the effect of the aureomycin-chloramphenicol group which was not in widespread ophthalmic use at that time. Acquired antibiotic resistance was, therefore, restricted to penicillin, streptomycin, and the sulphonamides.

Material

Patients cultured in this investigation were in-patients of two ophthalmic hospitals, to be called A and B, who had been admitted for operative procedures; they were fairly equally distributed between males and females and their ages ranged from 1 to 90 years. No attempt has been made to assess the effect of age and sex upon the flora of the conjunctiva.

Before culture the clinical cleanliness of the eye was assessed and a history of past antibiotic treatment was requested. This history may not have been reliable in many cases, since a patient had frequently had drops without being aware of their exact nature.

Cultures were taken by three technicians, one of whom worked throughout the period at A while the other two each worked for one year at B. An almost equal number of cultures was taken at the two hospitals, thus enabling a check to be made on bacteriological procedures at each centre.

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Whenever more than one culture was taken from a patient only the first was considered in this survey.

Media prepared at a central laboratory consisted of nutrient agar with 10 per cent. horse blood added.

Five thousand cases were investigated and in 95 per cent. cultures were taken from both eyes, hence the results are expressed per patient not as individual cultures.

Methods

Cultures were taken either at the bedside or in the out-patient department before admission to the wards; before the cultures were taken all antibiotic treatment was suspended for a minimum of 24 hours, but other therapy was not discontinued. The material for culture was taken from the lower conjunctival fornix with a platinum loop, care being taken to avoid blinking; the material so obtained was plated directly upon a blood agar plate, half a plate being used for each eye.

The cultures were incubated aerobically for 18 hours at 37°C., and were examined by one of three bacteriologists; on any given day, however, all plates were examined by the same individual. No anaerobic cultures were made and the plates were not incubated in the presence of carbon dioxide.

The antibiotic sensitivity of all potentially pathogenic organisms was determined by the filter paper disk technique, the sterile disks being saturated in antibiotics of the following concentrations :

Penicillin	500 units per ml.
Streptomycin	200 μg. per ml.
Aureomycin and chloramphenicol ...	500 μg. per ml.
Albucid	0.5 per cent. solution.

As a routine procedure organisms were tested against penicillin, and those found resistant were retested against the other antibiotics. In the latter part of the investigation, " coliform " organisms were tested for sensitivity to polymyxin by a serial dilution method.

Results

Table I shows the proportion of sterile cultures and pathogenic and non-pathogenic organisms at A and B and in total. There were less sterile cultures at A than at B; the percentage of pathogenic organisms was roughly equal. This difference is statistically significant and the cause for it will be discussed later.

The relative frequencies of the main species of bacteria isolated are set out in Table II. In Columns A and B only 4,000 of the 5,000 cases are considered, while all 5,000 cases are analysed in the total; since the numbers involved are so large it is legitimate to make comparisons between these groups. There is a close agreement between the frequencies of each species in these groups with two exceptions: *C. xerosis* and the " coliform " group. These organisms were significantly more frequent at A than at B, and account for the lower number of sterile cultures at A than at B.

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TABLE I

TYPES OF CULTURES OBTAINED

Series	A		B		Total	
	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.
Cultures...	2,671	53·42*	2,329	46·58*	5,000	100
Sterile	1,132	42·38	1,219	52·34	2,351	47·02
Showing Growth ...	1,439	57·62	1,110	47·66	2,649	52·98
Pathogens only... ...	382	14·30	343	14·73	725	14·50
Non-pathogens only ...	811	30·66	577	24·77	1,388	27·66
Mixed Pathogens and Non-pathogens ...	333	12·46	203	8·72	536	10·72
Total showing Pathogens	715	26·77	546	23·44	1,261	25·22

* Percentage of grand total; other percentages in these columns are of individual hospital totals.

TABLE II

FLORA OF HEALTHY CONJUNCTIVA

Series	A		B		Total	
	Number	Per cent. of Cultures	Number	Per cent. of Cultures	Number	Per cent. of Cultures
Staphylococci (all) ...	726	33·90	637	34·69	1,689	33·78
Coagulase-positive staphylococci ...	—	—	—	—	397	7·94
Pneumococci	69	3·22	62	3·33	161	3·22
Haemolytic streptococci	5	0·23	8	0·43	15	0·30
Other streptococci ...	17	0·79	15	0·83	44	0·88
N. catarrhalis	62	2·91	51	2·74	113	2·26
C. xerosis	715	33·39	499	26·84	1,555	31·10
" Coliforms "	54	2·52	32	1·74	103	2·06
H. influenzae	12	0·56	3	0·16	18	0·36
B. proteus	12	0·56	—	—	19	0·38
Klebsiella pneumoniae ...	3	0·14	1	0·05	7	0·14
Moraxella	5	0·23	—	—	5	0·10

Since this discrepancy is statistically significant it is important to determine its probable cause. There seem to be three main possibilities:

(*a*) *Patients attending A and B drawn from different populations.*—Since both hospitals are situated in London and serve similar geographical areas it is unlikely that bacterial flora would be unalike in these groups. Furthermore, only two species of bacteria are involved and population differences would be expected to have a more widespread effect.

(*b*) *Techniques of taking cultures varied.*—Although every attempt was made to standardize technique, differences in the force used to draw the loop across the conjunctiva can affect the results of cultures. For example, it is known that *C. xerosis* is adherent to the conjunctival cells, so that the more cells are detached by the platinum loop the more frequently will this organism be isolated.

This seems to be the most probable reason for the greater number of isolations of *C. xerosis* at A, but it will not account for the greater number of "coliform" organisms as these are not adherent to the conjunctival cells.

(*c*) *Cross infection.*—While it is most unlikely that simple cross infection from conjunctiva to conjunctiva could occur, there is a means by which organisms can spread rapidly from eye to eye in ophthalmic hospitals, namely by the communal use of drops containing bacteria. The possibility that this mechanism influences the incidence of "coliform" organisms is supported by the fact that the bacteria were often isolated from several patients at the same time. It has also been our experience that "coliform" organisms are those most frequently isolated from infected eye drops.

In considering the group of organisms termed "coliform", the name has been used for Gram-negative bacteria which would grow upon MacConkey agar at 37°C. No exact differentiation into species was made and it is possible that some of these organisms may not have belonged to the genus *Escherichia*. Cason and Winkler (1954) noted that Gram-negative bacilli are being isolated with increasing frequency from the conjunctiva, and that the *Pseudomonas* and *Aerobacter* are two of the most important of these species; it is possible therefore that a number of our "coliform" organisms may belong to these genera.

A number of organisms not associated with human infections were excluded from Table II. Thus, though occasional colonies of various micrococci and *B. subtilis* were encountered, they were not considered to be true inhabitants of the conjunctival sac. It has, however, been shown that *B. cereus*, which it closely allied to *B. subtilis*, may infect the eye (Davenport and Smith, 1952).

The change in ocular flora is shown in Table III, in which the findings of workers over the past 50 years are compared. The decrease in the percentage of cultures showing organisms is most striking, particularly where Pillat's figures are concerned; but these should be treated with reserve, as they show a much higher incidence of pathogenic organisms than do any other series. Whether or not all the changes shown in Table III can be attributed to antibiotics is doubtful. It is probable that both changing hygiene

TABLE III

COMPARISON OF REPORTED INCIDENCE OF VARIOUS STRAINS OF BACTERIA IN THE HEALTHY CONJUNCTIVA (EXPRESSED AS PERCENTAGES)

Author		Rymowicz	Pillat	Von Pellathy	Gibson	Barfoed	Smith
Date		1902	1922	1932	1951	1953	1954
Organism	*C. xerosis* ...	94	100	51	30	32	31
	Staphylococci ...	87	94	68	62	43	34
	Pneumococci ...	9	41	18	—	0·8	3·22
	Moraxella ...	6	22	9·5	—	—	0·10

and the geographical area from which the population studied was drawn may be of importance. The part played by climate is suggested by a report from Queensland (Gibson, 1951), where 62 per cent. of healthy conjunctivae contained staphylococci, whereas in this series there were only 34 per cent., it being known that staphylococci are more prevalent in hot climates.

Relation of Clinical Condition to Bacterial Flora.—Although the eyes which showed minor stickiness and were classified as dirty were, in fact, less frequently sterile than the clinically clean cases, attempts to relate the precultural condition of the eye to the bacterial flora were not highly successful. The relationships are set out in Table IV which shows that antibiotics markedly increase the percentage of sterile cultures in both clinically clean and dirty eyes.

TABLE IV

RELATIONSHIP BETWEEN CLINICAL CONDITION OF CONJUNCTIVA AND STERILE CULTURES

Clinical Condition	No. of Cultures	Percentage with Sterile Cultures
"Clean"	4,864	49·4
"Dirty"	136	34·56
"Clean" but previous antibiotic treatment ...	213	60·0
"Dirty" but previous antibiotic treatment ...	37	50·6

Antibiotic Resistance of Ocular Bacteria.—The results of sensitivity tests on potentially pathogenic organisms isolated in this survey are set out in Table V. It will be seen that of all the bacteria isolated only one was insensitive to all the antibiotics used—this was a strain of *B. proteus*.

TABLE V

ANTIBIOTIC RESISTANCE OF CONJUNCTIVAL PATHOGENS

Resistance of Pathogens	Number	Percentage of all Cultures
Penicillin-resistant	210	4·20
Penicillin-resistant staphylococci	128	2·56
Organisms resistant to all antibiotics	1	—
Penicillin-resistant staphylococci as percentage of all staphylococci	—	14·4

Probably the most important pathogenic organism in the healthy conjunctiva is the staphylococcus; with these bacteria the increasing frequency of antibiotic-resistant strains, noted in other parts of the body, is also seen in the eye. This trend is particularly important with penicillin, to which one in six of all the staphylococci isolated was resistant, but during the period under review these penicillin-resistant strains were all sensitive to either streptomycin or aureomycin. More recent cultures than those reported here show an increasing number of strains which are becoming resistant to the newer antibiotics.

Discussion

In general these results follow closely those of modern investigators (Gibson, 1951; Barfoed, 1953) for the conjunctival flora; the main differences being a lower incidence of staphylococci and a higher incidence of such organisms as pneumococci and coliforms. Since Gibson was reporting on the flora of Queensland, and Barfoed on that in Denmark, it is possible that these differences may merely reflect varying climatic conditions. In complete contrast are the figures given by investigators in the pre-antibiotic period (Rymowicz, 1901; Pillat, 1922; Von Pellathy, 1932; cited by Duke-Elder, 1938). Without exception these figures show a higher percentage of both pathogenic and non-pathogenic organisms (Table III), and it seems unlikely, as has been stated earlier, that this can be attributed to any one factor, even one so potent as the modern chemotherapeutic agents.

While in general the number of bacteria isolated has fallen, "coliform" organisms, which occurred in 2 per cent. of all the ocular cultures, were present more frequently in our series than in any other found in the literature except Cason and Winkler (1954). This may be due to one of two factors:—either they replace other organisms in the conjunctiva which have been destroyed by antibiotic treatment, or they may be introduced by the use of unsterile drops.

It is probable that both these mechanisms play a part, as it is known that antibiotics in the mouth cause the usual mouth streptococci to be replaced by coliforms, and there seems no reason why a similar removal of staphylo-

cocci and diphtheroids might not lead to a coliform invasion of the conjunctiva. The importance of unsterile eye drops is probably greater; this is particularly the case with flourescein, penicillin, and cortisone, each of which provides a most suitable culture medium for Gram-negative bacilli if contaminated by them; recent outbreaks of *Ps. pyocyaneus* infection of the eye have been found to result from such contamination of eye-drops.

The antibiotic resistance encountered in this survey is lower than that found by many authors, particularly as regards staphylococci; Laurell and Wallmark (1953), reviewing the literature on this subject, quote papers in which up to 64 per cent. of staphylococci were resistant to penicillin. The figure of 14 per cent. reported here is much more in keeping with the level found in the population at large, rather than in hospital in-patients; this might be predicted since the cultures are taken soon after admission to hospital. It would be interesting to compare the sensitivities of organisms isolated from the conjunctiva before and after operation as this would provide a guide to the amount of hospital cross infection.

It seems unlikely that any single antibiotic would be satisfactory in sterilizing the conjunctiva, and combinations of antibiotics must be regarded with caution since some may be less efficacious than either component alone (Jawetz and others, 1952); apart from the risk of allergic reactions, the most useful combination would seem to be streptomycin and penicillin, and it is possible that a mixture of polymyxin and bacitracin which has a wide spectrum of antibacterial activity may be more satisfactory. Both these combinations of antibiotics are rapidly bactericidal, a point of importance in the healthy conjunctiva where the rate of multiplication of bacteria is almost certainly low and hence bacteriostatic drugs would be unlikely to produce sterility.

It is impossible to say that pre-operative cultures are no longer necessary when up to 25 per cent. of cases have potentially pathogenic organisms present, but it seems that, unless extreme care is taken in the use of eye drops in the period between culture and operation, there is a risk of replacing one pathogen by another, thus reducing the value of the pre-operative culture. To overcome this, two suggestions might be made: that cultures should be made as short a time as possible before operation, and that a combined drop of two bactericidal antibiotics with a wide range of antibacterial activity should be used if antibiotics are thought to be necessary.

Summary

(1) The bacterial flora has changed in the last 50 years with a decrease in the frequency of isolation of both pathogenic and non-pathogenic organisms. This is probably due, in part, to the use of antibiotics.

(2) Because Gram-negative bacilli are found in the eye with increased frequency, prophylactic pre-operative drops should contain an antibiotic

active against these organisms, for example streptomycin or polymyxin.

I wish to acknowledge the assistance which Dr. Norman Ashton and Dr. C. H. Greer have given me in the preparation of this paper.

REFERENCES

BARFOED, P. (1953). "Conjunctivas Bakterieflora". Munksgaard, Copenhagen.
CASON, L., and WINKLER, C. H. (1954). *Arch. Ophthal. (Chicago)*, **51**, 196.
DAVENPORT, R., and SMITH, C. (1952). *British Journal of Ophthalmology*, **36**, 389.
DUKE-ELDER, S. (1938). "Text-book of Ophthalmology", vol **2**, p. 1533. Kimpton, London.
GIBSON, J. B. GILCHRIST (1951). *Med. J. Aust.*, **2**, 355.
JAWETZ, E., GUNNISON, J. B., BRUFF, J. B., and COLEMAN, V. R. (1952). *J. Bact.*, **64**, 29.
LAURELL, G., and WALLMARK, G. (1953). *Acta path. microbiol. scand.*, **32**, 438.
PELLATHY, B. VON (1932). *Klin. Mbl. Augenheilk.*, **89**, 108. *Cited by* Duke-Elder (1938).
PILLAT, A. (1922). *Klin. Mbl. Augenheilk.*, **68**, 533. *Cited by* DUKE-ELDER (1938).
RYMOWICZ, F. (1902). *Post. okul. (Kraków)*, **4**, 389.

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SIDEROSIS BULBI*

BY

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From the Department of Ophthalmology, University of Toronto

SIDEROSIS bulbi is a pigmentary and degenerative change in the eye that follows the intra-ocular retention of a foreign body containing iron. The pathological anatomy of siderosis was first reported by von Hippel (1894), who distinguished two types of siderosis: haematogenous, in which the iron was derived from the blood, and exogenous, in which it came from an intra-ocular foreign body.

This paper will deal with the latter, discussing corrosion of iron, its diffusion and precipitation throughout the eye, the pathological changes, and the clinical picture.

Corrosion of Iron.—Corrosion is the destruction of a metal resulting from its contact with a liquid. Factors which increase the velocity of corrosion are the presence of oxidizing agents, uneven surfaces of the metal, agitation of the liquid, higher temperature, and greater alkalinity. The human eye offers an optimal situation for corrosion.

Diffusion and Precipitation of Iron.—The chemical processes in ocular siderosis have been debated for years. Von Graefe (1860) thought that the iron diffuses through the eye in the form of oxides. Leber (1882) felt that a solution of iron bicarbonate is formed, which then is oxidized and precipitated in the ocular tissues. The theory of Mayou (1925, 1926) was that iron is in the form of colloidal ferric hydroxide, which is positively charged. Bunge (1891) considered that the iron is dissolved by carbonic acid, circulated as a soluble carbonate being deposited in an insoluble form by the action of acid salts. Friedenwald (1954) believes that the staining of tissues by iron is due to ferric ions in low concentration which combine with sulph-hydryl groups in the cells.

Particles of oxidized iron tend to precipitate in ectodermal cells. Many theories have been advanced to explain this fact. Mayou (1925, 1926) feels that the activity of epithelial cells renders them negatively charged. The negative charge attracts the positively charged colloidal particles. Wolff (1951) did not ascribe to certain tissues a special affinity for iron, but thought that all living cells took up iron more readily than the connective tissue, and that connective tissue took up more iron that the glass-like membranes.

Pathology.—The epithelium of the ciliary body is the first tissue affected and the non-pigmented epithelium stains earlier. The iris is affected most at the anterior limiting layer and in the sphincter and dilator muscles. Macro-

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† Work done while Hermant Fellow in Ophthalmology.

phages laden with iron pigment are commonly found in the trabecular meshwork. The retinal pigment epithelium is invariably affected. The ganglion cells are involved and macrophages laden with pigment surround the retinal vessels. When the lens has been damaged the subcapsular epithelium is affected.

The action of the pigment on the cells is at first irritative and later destructive. The ganglion cells of the retina degenerate and are replaced by glial tissue. The cells of the retinal pigment epithelium take up iron, proliferate, invade the retina, and tend to collect around the retinal vessels.

A microscopic picture resembling retinitis pigmentosa occurs, and degeneration of the eye continues until phthisis results (Fig. 1*a-e*).

Fig. 1(*a*).—Iron deposits in dilator muscle and proliferating subcapsular epithelium of the lens.

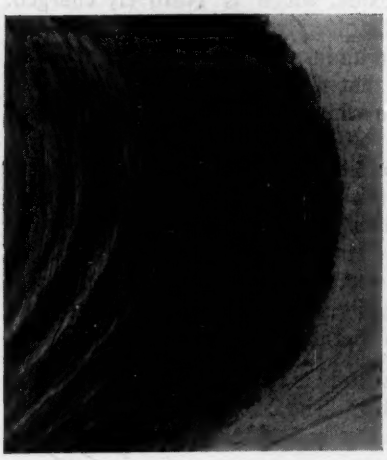

Fig. 1(*b*).—Iron in subcapsular epithelium extending just posterior to equator.

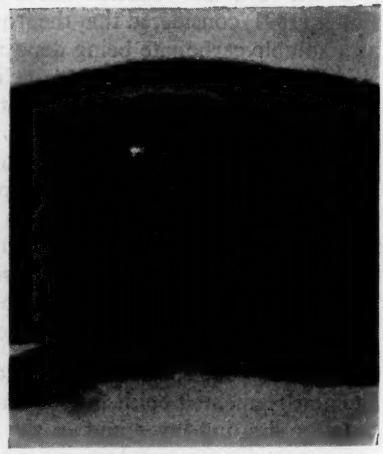

Fig. 1(*c*).—Iron in corneal stroma, spreading from foreign body tract.

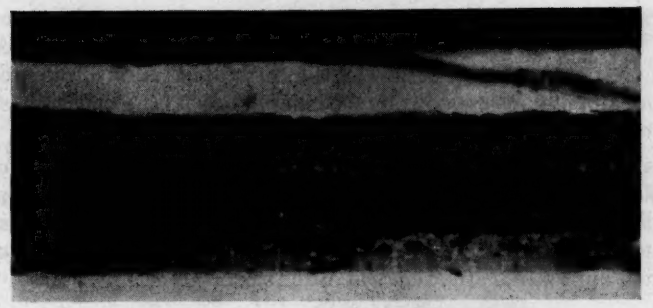

Fig. 1 (*d*).—Perivascular collections of iron in retina.

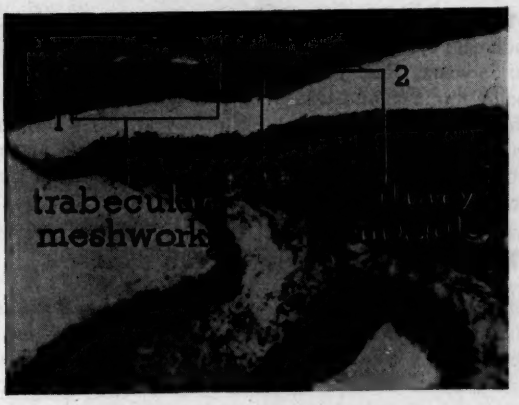

Fig. 1 (*e*).—Positive staining for iron in the trabecular meshwork and in ciliary muscle.

Clinical Findings.—The process of siderosis bulbi may be divided into three stages:

(*i*) Latent period following injury before clinical signs are manifest. This period varies from a few weeks to many years, depending on the site and the nature of the foreign body.

(*ii*) Spread of iron through the ocular tissues. The diffusing iron stains all epithelial structures with which it comes in contact.

(*iii*) Degeneration of the tissues, particularly the retina, due to the toxic effect of the iron.

The dilated pupil, which is one of the earliest signs of siderosis, is due to the precipitation of iron in the sphincter and the dilator muscles, rendering them inactive. Night blindness is an early symptom, probably due to the deposition of iron in the pigment epithelium of the retina. Heterochromia develops as more and more iron is deposited in the iris musculature and epithelium. Cataract and pigmentation of the lens epithelium develop if the lens capsule is injured. Iridocyclitis is a constant feature of siderosis, but

posterior uveitis does not occur unless Bruch's membrane has been penetrated. Glaucoma is a common complication and may be due either to blocking of the trabecular meshwork with macrophages or to the production of a more albuminous aqueous by the ciliary body. Loss of vision is usually due to retinal degeneration.

Cases in which the signs and symptoms of siderosis disappeared following removal of the foreign body are on record. Genet (1924) reported a case in which he removed the foreign body 7 months after the injury and the siderosis completely disappeared. Collins (1894) described an eye which returned to its normal appearance after removal of the steel.

Present Study

Material.—The clinical history and microscopic sections of twenty enucleated siderotic eyes were studied. All were from male patients ranging in age from 18 to 58 years. The most frequent source of the foreign body was shrapnel, the next being hammer and chisel. The length of time the foreign body had remained in the eye varied from one week to 13 years. The commonest location of the foreign body was free in the vitreous. At the time of enucleation vision was minimal or absent, and iridocyclitis was present in every case. In all cases in which pupillary reactions were recorded they were sluggish or absent. Heterochromia was recorded as present in seven eyes. Ocular tension was recorded as above normal in three eyes and as subnormal in three eyes.

Method.—Each enucleated eye was placed in 10 per cent. formalin for 48 hrs. and then washed in tap water for 6 hrs. The specimen was then examined grossly, and sectioned in a horizontal plane, special attention being directed to the presence and location of any magnetic foreign body. The central portion was embedded in celloidin. Sections 20 microns thick were cut and the following six staining combinations employed:

(1) Haematoxylin and eosin.
(2) Prussian blue.
(3) Haematoxylin, eosin, and prussian blue.
(4) Bleached section.
(5) Bleached section and prussian blue.
(6) Bleached section, haematoxylin, eosin, and prussian blue.

The sections were bleached in 0·05 per cent. potassium permanganate followed by 0·33 per cent. oxalic acid. The normal ocular pigment was bleached but the iron was not. For control purposes, eyes with a history of chronic recurrent intra-ocular haemorrhage, massive haemorrhages in the vitreous, and blood staining of the cornea were stained by these methods. The dark blue granular staining of exogenous siderotic pigment was not obtained.

Microscopic Findings.—The non-pigmented ciliary epithelium and the pars plana ciliaris were the most common sites of impregnation by iron. The prussian blue reaction was obtained at these sites in all twenty eyes. The retinal pigment epi-

thelium was the next most common site, being involved in seventeen of the twenty eyes. The iris was commonly involved, the dilator muscle showing iron in ten eyes and the sphincter in eleven eyes. The retinal ganglion cells contained iron in thirteen eyes, the internuclear layers in thirteen. Perivascular collections were present in seven. The trabecular meshwork contained iron in ten. The subcapsular epithelium of the lens was involved in seven, in each of these a rupture of the lens capsule was identified. The corneal stroma or the endothelium stained in five. The circular fibres of the ciliary muscle were affected in two. The optic nerve showed positive staining for iron in two; the choroid of two eyes and the sclera of one carried iron. In no case did the conjunctiva contain iron (Fig. 2).

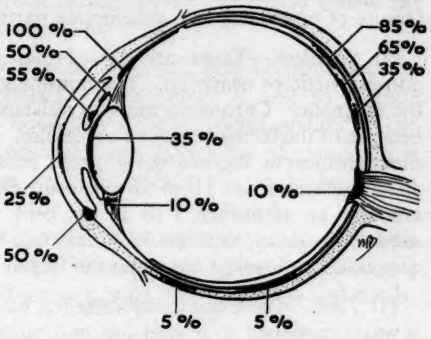

Fig. 2.—Frequency of sites of positive staining in twenty cases of siderosis.

Foreign Bodies

In a survey of one hundred intra-ocular foreign bodies of a ferrous nature, all were found to be magnetic and corrosive. Hammering steel was the commonest cause of injury. A cold chisel or punch (shock tools hardened for cutting) were the commonest tools responsible. Automobile parts, such as axle bearings and king pins, were second, and nails, structural steel, and hammers were involved in that order. Broken drills, lathes, shapers, grinding, and sanding were responsible in a smaller number of cases. Explosions, dropped castings, and chains were only occasionally the cause (Fig. 3).

Fig. 3.—Origin of foreign bodies in a hundred cases. The hammer being the most likely source in 72 cases.

An investigation into the types of steel and steel alloys used in industry

and in the manufacture of tools revealed four classes of steel:

(*1*) *Standard Alloy.*—These contain iron, carbon, and manganese, and smaller amounts of nickel, chromium, and molybdenum. These steels are all magnetic and corrodible in dilute saline solutions. They are widely used for the manufacture of machinery and automotive parts.

(*2*) *Stainless.*—There are two broad classes, one magnetic and the other non-magnetic or nearly so. The non-magnetic is more resistant to corrosion than the magnetic. Chromium imparts resistance to oxidizing effects in steel, probably because of the formation of an oxide film. The natural effect of nickel is to supplement chromium, increasing the steel's resistance to corrosion. Magnetic stainless steel contains from 11 to 16 per cent. chromium. Non-magnetic stainless steel contains an additional 8 to 18 per cent. nickel. The stainless steels are widely used in the dairy, meat-packing, canning, beverage, and pharmaceutical industries, and modern hospital equipment is largely made of stainless steel.

(*3*) *Tool.*—There are many varieties, each developed for a specific task. There is water-hardened tool steel for maximum wear resistance in cutting tools, drills, taps, and reamers. Oil-hardened tool steel is used for tools of intricate design. High-speed hot-work tool steel is used for cutting tools, dies, and shock tools. All are magnetic and corrosive.

(*4*) *Manganese.*—Steel containing 12 per cent. manganese is non-magnetic and offers little resistance to corrosion. This steel is widely used for parts required to resist abrasion, such as steam-shovel bucket teeth, and the jaws of crushers and grinders.

Discussion

The incidence of siderosis bulbi is fortunately low. The majority of cases included in this study were due to war injury, sustained in situations which lent themselves to unsuspected and thus undetected, intra-ocular foreign bodies. Moreover, fragments from war missiles are commonly non-magnetic. In peacetime most intra-ocular foreign bodies are recognized early and steps for their removal are not delayed.

When a metallic foreign body enters the eye the rate of development and the severity of the resulting siderosis depend upon:

(*a*) The shape, size, and corrosive properties of the foreign body;
(*b*) The site of the foreign body;
(*c*) The associated trauma and resulting tissue reaction.

The shape of the foreign body is important. An irregular, roughened fragment will corrode more quickly than one that is smooth and regular. The size is important from the standpoint of the area of surface available for oxidation. Small pieces may completely oxidize and the siderosis regress. The corrosive properties of the metal are important. Iron and carbon steel offer less resistance to corrosion than do some of the alloyed steels. Non-magnetic steel only very rarely causes siderosis bulbi. There are two reasons for this: its toughness greatly reduces the possibility of fragments being struck from it, and it resists corrosion even more than do the magnetic stainless steels.

The site of the foreign body governs both the rate and the extent of tissue staining. The process is rapid when the metal is bathed in the ocular fluids and slow when it lies in tissues of low metabolism such as the lens and the cornea.

Associated trauma, such as rupture of the lens capsule and Bruch's membrane, facilitates the dispersion of iron. Fibrous tissue may so completely encase the foreign body that indirect siderosis does not occur.

In many cases clinical manifestations of siderosis are complicated by traumatic disruption of the ocular tissues. However, it is safe to assume that the pupillary changes and night blindness are two direct results of the deposition of iron in the cells. The incidence and the course of glaucoma is complicated by the associated trauma and no conclusions could be drawn from this study.

In the microscopic study of siderosis, a bleached section stained only with prussian blue is ideal for the quick detection of iron. Bleached sections, stained with prussian blue and counter-stained with haematoxylin and eosin, are best for detailed study.

Summary

(1) Siderosis bulbi denotes pigmentary and degenerative changes in the eye following the retention of an intra-ocular foreign body of ferrous nature.

(2) The products of corrosion, in the form of a colloidal suspension of ferric hydroxide, diffuse slowly through the tissues of the eye, and accumulate in the more active cells of the ocular tissue, but are stopped by the glass membranes of the eye.

(3) When iron comes in contact with cells there is first proliferation and ultimately destruction of the cells.

(4) The common clinical findings in siderotic eyes are pupillary abnormalities, heterochromia, and night blindness. More serious complications such as cataract and retinal degeneration follow.

(5) Foreign bodies of a ferrous nature entering an eye in peacetime are almost invariably magnetic and corrosive.

REFERENCES

BUNGE, P. (1891). "Verh. int. med. Congr., Berlin, 1890", vol. 4, pt. 10, p. 151. *Cited by* Levine (1934).
COLLINS, E. TREACHER (1894). *Trans. ophthal. Soc. U.K.*, **14**, 217.
FRIEDENWALD, J. S. (1954). Personal communication.
GENET, L. (1924). *Clin. ophtal.*, **28**, 172 and 425. *Cited by* Levine (1934).
GRAEFE, A. VON (1860). *v. Graefes Arch. Ophthal.*, **6**, pt. 1, p. 134.
HIPPEL, E. VON (1894). *Ibid.*, **40**, pt. 1, p. 123.
LEBER, T. (1882). *Ibid.*, **28**, pt. 2, p. 237.
MAYOU, S. (1925). *Trans. ophthal. Soc. U.K.*, **45**, 274.
——— (1926). *Ibid.*, **46**, 167.
WOLFF, E. (1951). "A Pathology of the Eye", 3rd ed., p. 217. Lewis, London.

ADDITIONAL BIBLIOGRAPHY

DUKE-ELDER, S. (1940). "Text-book of Ophthalmology", vol. 3, p. 2420. Kimpton, London.
GUNDERSON, T. (1934). *Amer. J. Ophthal.*, **17**, 807.
LAMB, H. D. (1928). *Trans. Amer. ophthal. Soc.*, **26**, 161.
LEVINE, J. (1934). *Arch. Ophthal., (Chicago)*, **11**, 625.

Brit. J. Ophthal. (1954), **38**, 734.

CLINICAL OBSERVATIONS ON THE PROPHYLAXIS OF OPHTHALMIA NEONATORUM*

BY

IDA MANN

Perth, Western Australia

THE following precepts concerning inflammation of the eyes of the newborn are taught to all students:

(1) Purulent conjunctivitis affecting newborn babies is not invariably due to the gonococcus but may be caused by streptococci, staphylococci, or even *B. coli* and *B. proteus*.

(2) Blindness from this cause in England has been reduced from approximately 25 per cent. of all blind children in 1920 to 9 per cent. in 1940.

(3) This improvement began when the use of the Crédé method of prophylaxis with silver nitrate became universal in England.

(4) Silver nitrate is superior to other antiseptics because it is non-specific, and because it acts in two ways: by precipitating as a thin film of silver chloride on the surface of the conjunctiva, mechanically entangling all organisms, and by producing a non-specific inflammatory reaction in the sub-conjunctival tissue, leading to the formation of the lymphoid layer earlier than it would normally appear and so strengthening the resistance of the eye to infection.

The drop in the incidence of ophthalmia neonatorum has however almost coincided with the discovery of the use of the antibiotic penicillin in the treatment of gonorrhoea and pyogenic infections in general, so that, not only has the incidence of gonorrhoea fallen, but also, should a gonorrhoeal ophthalmia develop, its rapid cure is always possible. It therefore seems time to take stock of our position with regard to the necessity or otherwise of prophylactic treatment of the eyes of newborn babies.

This question is being debated all over the world, and no universal point of view is possible, since the incidence of gonorrhoea and the availability of treatment of this and of ophthalmia neonatorum vary from country to country. It therefore seems desirable to collect local data and to give local rulings for the present on the best procedure.

Standard Practice in Various Countries

United States of America.—There is no standard procedure, each State having its own code of rules for midwives. In some States, silver nitrate is obligatory, in

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others not. In some, the obstetrician in charge of each hospital can make his own local rules. Berens writes:

> In States which require the instillation of silver nitrate into the eyes after birth, the incidence of gonococcal ophthalmia has become almost negligible. In areas in which this procedure is not followed, the disease occurs in a high percentage of babies.

Berens further recommends that the eyelids should be cleansed, before opening, with 1 in 3000 bichloride of mercury, and that then 1 per cent. silver nitrate should be instilled. He adds:

> Although silver nitrate is currently the most satisfactory preparation, the value of penicillin and the sulphonamides is under investigation and it is probable that silver nitrate will be entirely supplanted in the future.

England.—There has been a great deal of discussion between the Ministry of Health and the Central Midwives' Board. At the moment no prophylactic drops are recommended by the Ministry, and only thorough cleansing of the lids is to be carried out. Hospitals may however make their own local rules as in parts of America, and some still use silver nitrate, while some favour penicillin and some 20 per cent. sodium sulphacetamide. The Central Midwives' Board advises midwives to conform to local usage, but those going to work abroad are advised to use antibiotics.

Western Australia.—Gonorrhoea is not a common disease, and in the Perth School for the Blind there is no child who has suffered from ophthalmia neonatorum. It has therefore been felt that a review of the position is needed, since the King Edward Memorial Maternity Hospital has continued the routine use of prophylactic silver nitrate since its foundation. There is some dislike of the reaction caused by silver nitrate, but on the other hand, in view of the prevalence of penicillin-resistant strains of staphylococci in this State, it is not considered wise to substitute routine antibiotics.

Clinical Experiment

It was therefore decided to try to settle the matter by clinical and bacteriological observation. Two groups of infants were involved. The first group (controls) comprised 569 live births at the King Edward Memorial Hospital, Perth, and these received no prophylactic drops, all that was done being cleansing of the lids at birth with swabs dipped in normal saline. The second group comprised 579 live births, and all these received, in addition to the cleansing of the lids, one drop of a 1 per cent. solution of silver nitrate (Table I).

The two groups were compared for incidence of discharge from the eyes after birth, for the day after birth on which the discharge was first noted, for the result of culture of the discharge, for the sensitivity of the organisms obtained to various antibiotics, and for the clinical course of the case.

It may be stated at the outset that in neither group did any case of severe purulent ophthalmia occur, and that the end result (clean eyes on discharge from hospital) was the same in every case in both groups (1,148 babies). There is, therefore, no absolute indication for use or disuse of silver nitrate, but during the course of the observations some interesting data were obtained, which bear out Crédé's original contention of the value of silver nitrate as an antiseptic. However, should a case of purulent ophthalmia occur, its cure by modern methods is almost certain, and there is thus no actual need for prophylaxis.

In all cases the routine procedure was to record the observation of any stickiness *at all*, and the day on which it was first noticed.

Comparison of Groups.—In the control group without silver nitrate, a hundred cases were noted out of 569 births (17·5 per cent.). The commonest time of onset was the 3rd day, the next commonest the 7th day. This raises the question of the origin of the infection, and it was decided arbitrarily to take the 4th day as the limit for the appearance of discharge due to a natal infection from the birth canal. Stickiness appearing after this day was considered to be due to post-natal infection. If this is accepted, then forty of the hundred cases reported were natal in origin, and eight of these occurred within 24 hours.

In the group treated with silver nitrate, 72 cases were noted in 579 cases (12·4 per cent.). This in itself is a reduction in the number of sticky eyes. Of these 72 cases, 44 occurred on or before the 4th day and 27 of these within 24 hours. This makes us wonder whether these 27 were actually infections rather than reactions to the silver nitrate. Of the 44, 39 were cultured, and of these 23 showed no growth, two showed a white staphylococcus, non-haemolytic and coagulase negative, and the fourteen others showed potential pathogens. We can therefore consider 25 of these 44 to be due to silver nitrate reaction, which leaves us with only 47 infections in the whole group as opposed to an apparent 100 in the control group. Of these hundred, however, forty occurred in the first 4 days and only eight showed no growth, while nineteen showed potential pathogens, and the remaining nine showed a white staphylococcus, non-haemolytic and coagulase negative (Tables II and III).

In the control group, therefore, if these seventeen cases (eight " no growth " and nine *Staph. alb.* non-pathogenic) are discounted, nineteen cases showed potential pathogen infection, and in the silver nitrate group in the same period fourteen such cases appeared. This is not a vast difference and upholds one side of the argument, namely that silver nitrate causes an unnecessary amount of irritation of the eyes and in the absence of gonorrhoeal infection does very little else.

On the other hand, if we consider discharge from the eyes throughout *the first 12 days* of life as a whole, we find an incidence of 17·5 per cent. in the control group and of only 12·4 per cent. in the treated group. If in both groups we subtract the cases in the first 4 days which showed no pathogen on culture we find the figures become 14·5 per cent. in the control group and only 8·1 per cent. in the treated group. It therefore seems that the use of silver nitrate very definitely reduces the incidence of infection as distinct from discharge during the first 12 days of life. Tables I–III and the Figure show the incidence of discharge from the eyes and of true infection.

It is thus obvious that the clinical picture is different in the two groups, the control group showing a tendency for discharge to appear at any time during the first 12

TABLE I

INCIDENCE OF DISCHARGING EYES

Group	No. of Live Births	No. of Discharging Eyes	Percentage
Control	569	100	17·6
Treated ($AgNO_3$)	579	72	12·4

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TABLE II

INCIDENCE OF PATHOGENS

Group	Total Discharging Eyes	No. of Pathogens found in first 4 days	Pathogens in first 12 days as Percentage of Live Births
Control	100	17	14·6
Treated	72	25	8·1

TABLE III

DAY DISCHARGE FIRST NOTED

Day	1	2	3	4	5	6	7	8	9	10	11	12	12+
Control Cases*	8	12	13	7	11	10	12	5	8	5	3	1	4
Treated Cases†	27	5	7	5	4	4	5	1	6	3	1	2	–

*One case not known. †Two cases not known.

days, with peaks at 3 and 7 days, and the treated group showing immediate reaction to the silver nitrate followed by a drop in incidence with a slight rise on the 9th day.

Clinical Conditions.—The picture is further complicated by the fact that in many cases the condition was not a conjunctivitis only. In very few cases of either group was there any severe infection of the ocular conjunctiva, but in most there was slight redness of the palpebral conjunctiva of the lower lid. In the control group there were four cases of blocked tear duct, in the treated group none. In both groups there were a number of cases showing small pustules on the lids, especially the lower, and small septic skin eruptions on the body occasionally also. In the control group fourteen cases had skin pustules, in the treated group thirteen cases. In the control group there were also four cases of fairly severe conjunctivitis requiring careful treatment and taking up to 12 days to clear completely. In the treated group there was no severe conjunctivitis, in spite of the bacteriological findings to be described later, which appear worse than those of the untreated group. This may point to a greater resistance of the tissues in the

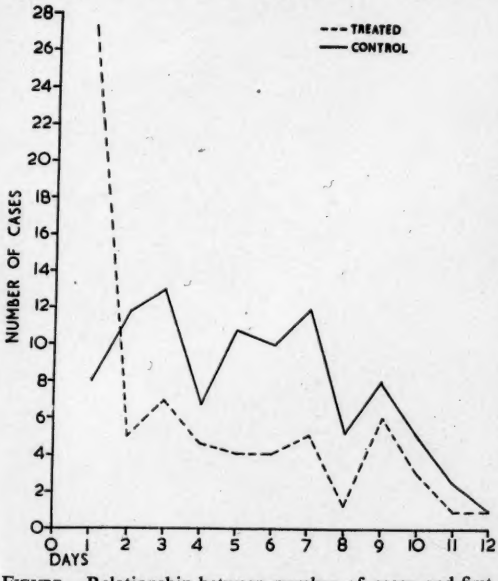

FIGURE.—Relationship between number of cases and first day of discharge in treated and control groups.

treated group, so that the more severe infections are not manifested clinically and the minor infections do not occur. The similar incidence of skin infections in the two groups seems to point to a local resistance in the eyes of the treated group.

Bacteriological Findings.—92 cases were cultured in the control group and 64 in the treated group. The main differences in the findings in the two groups are the greater number of sterile cultures in the treated group (showing that the discharge is largely due to reaction to the silver nitrate) and the greater number of non-pathogenic white staphylococci grown in the untreated group, which is rather to be expected. An unexpected finding is the greater number of double infections in the treated group; the significance of this is doubtful. Table IV shows the incidence of various types of organism in the two groups.

TABLE IV

ORGANISMS GROWN

Cultures		Control	Silver Nitrate	Total
Number		92	64	156
Organisms grown		78	37	115
Organisms not grown		14	27	41
Staph. albus	non-haemolyticus, coagulase negative	33	6	39
	haemolyticus, coagulase negative	7	None	7
	haemolyticus, coagulase positive	2	3	5
Staph. aureus	haemolyticus, coagulase positive	33	21	54
	haemolyticus, coagulase negative	1	None	1
Strep. viridans		1	None	1
Total		1	7	8
Double Infections	*Staph. albus* haemolyticus, coagulase negative, and *B. lactis aerogenes*	1	None	1
	Staph. aureus haemolyticus, coagulase positive, and *B. mesentericus*	None	1	1
	Staph. aureus haemolyticus, coagulase positive, and *Staph. albus* haemolyticus, coagulase negative	None	3	3
	Staph. aureus haemolyticus, coagulase positive, and *Staph. albus* non-haemolyticus, coagulase negative	None	1	1
	Strep. viridans and *Staph. albus* haemolyticus, coagulase negative	None	1	1
	B. coli and *Staph. albus* haemolyticus, coagulase positive	None	1	1

Table V (opposite) shows the day on which each infection appeared (where known) in both groups. The smear was taken on the first day in every case.

TABLE V

DAY ORGANISMS FIRST FOUND

Organism	Day of Culture																							
	1		2		3		4		5		6		7		8		9		10		11		12	
	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
No growth	4	21	2	1	1	2		1			2			1	1		3	1	1					
S. alb. non-haem. Co—	1	1	2		5	2	4	1	3	2	3		7				3	1	1		2		2	
S. alb. haem. Co—			1		2	1			3				1	1										
S. alb. haem. Co+	1		1	1							2							1						
S. aureus haem. Co+		2	5	2	5		3	3	5	2	5	3	3	3	2	1	1	3	1	2		1	3	2
B. mesentericus								1																
Strep. viridans						1																		
B. coli											1													
B. lactis aerogenes									1															
S. aureus haem. Co—																			1					

C=Control. T=Treated.

Sensitivity.—The question of the sensitivity of the various organisms to the more usual antibiotics was investigated in a certain number of cases, though not in all. It was not considered necessary to test more than a sample of the white staphylococci, and not all the organisms tested were tried against all the antibiotics.

Table VI (overleaf) shows that only streptomycin gave a universal result, no organism tested against it being negative. Aureomycin ran it close, with two negatives (both *Staph. aureus* from the treated group). Chloramphenicol gave 5, terramycin 10, sulphadiazine 29, and penicillin 35 negatives, the majority in the pathogenic *Staphylococcus aureus* group. This demonstrates very well the futility of the search for a universally protective drug, unless it is decided to use streptomycin exclusively. This would have the disadvantage of neutralizing actual birth infections only, which are not, in this hospital and at the present time, at all dangerous. It would not be likely to have a prolonged protective effect.

Penicillin and sulphadiazine are of little use and it is suggested that these substances should not be used in routine treatment. Unless a sensitivity test can be done, streptomycin is the antibiotic of choice in every case. From practical experience, however, it is usually unnecessary as clinical results show.

Clinical Course and Results

When an eye was found to be " sticky ", the procedure was to take a smear and culture and, before receiving the report, to treat with frequent cleansing of the lids with saline only. If the discharge did not respond within 4 days, sodium sulphacetamide drops were used 2-hourly, and aureomycin cream

TABLE VI

DEGREE OF SENSITIVITY

Degree of Antibiotic Sensitivity		*S. albus* non-haem. Co. C	*S. albus* non-haem. Co. T	*S. albus* haem. neg. Co. C	*S. albus* haem. neg. Co. T	*S. albus* haem. pos. Co. C	*S. albus* haem. pos. Co. T	*S. aureus* haem. pos. Co. C	*S. aureus* haem. pos. Co. T	*S. aureus* haem. neg. Co. C	*S. aureus* haem. neg. Co. T	*Strep. viridans* T	*B. coli* T
Penicillin	—	2	2	—	1		2	13	14	—	—	—	—
	+	3	1	3	1		1	25	8	—	1	—	—
	++	2	2	3	—		—	—	4	1	—	—	—
	+++	—	1	—	1		—	2	2	—	—	1	—
Streptomycin	—	—	—	—	—		—	—	—	—	—	—	—
	+	—	—	—	—		2	11	4	—	—	—	1
	++	6	2	5	3		1	21	20	—	1	1	—
	+++	1	—	1	—		—	3	2	1	—	—	—
Aureomycin	—	—	—	—	—		—	—	2	—	—	—	—
	+	2	3	2	3		2	9	19	—	1	—	1
	++	4	—	2	—		—	20	3	—	—	—	—
	+++	—	—	2	—		1	6	3	1	—	1	—
Chloramphenicol	—	—	—	—	—		1	—	5	—	—	—	1
	+	2	2	1	2		2	8	16	—	1	—	—
	++	4	—	3	—		—	22	3	—	—	1	—
	+++	—	1	2	1		—	4	2	1	—	—	—
Terramycin	—	—	—	—	—		1	2	6	—	—	—	1
	+	2	2	5	3		1	25	15	—	1	1	—
	++	3	2	—	—		1	2	2	1	—	—	—
	+++	—	—	—	—		—	—	—	—	—	—	—
Sulphadiazine	—	—	1	—	1		3	5	18			—	1
	+	—	—	—	—		—	1	—			—	—
Sodium sulphacetamide 20 per cent.	—	—	1	—	—		—	6	1			—	1
	+	1	—	1	—		—	3	—			—	—

C=Control. T=Treated.

was rubbed on if the skin was also infected. Every case cleared satisfactorily in both groups, but, on the whole, the control group took rather longer to become clear. Thus in 22 cases in the untreated group the infection lasted longer than 5 days, as against six cases in the treated group. The majority in both groups cleared with no treatment other than saline swabbing. Thus very little correlation was apparent between the bacteriological findings and the clinical course and response to treatment. Indeed, a case bacteriologically negative to sulphacetamide was often clear before the report came back. Clinical judgement, therefore, still remains the best guide to treatment and prognosis, and cleanliness still appears the surest road to cure in our present mild type of case. Silver nitrate would appear unnecessary but not ineffective as a routine prophylactic, though if the dislike of the initial reaction can be overcome it will obviate the need for subsequent treatment in a large number

of cases. It need not be recommended for use in an efficient hospital in a country with a low incidence of gonorrhoea, but should still be considered as desirable in primitive conditions among infected populations.

Summary

(1) The incidence, type, and course of ocular infections in the new born was investigated in 1,148 live births at the King Edward Memorial Hospital, Perth, Western Australia.

(2) The infants were divided into two groups. The controls received no prophylactic treatment at birth, other than cleaning the lids; the other group received one drop of 1 per cent. silver nitrate.

(3) Discharge from the eyes within the first 12 days occurred in one hundred of the control group of 569 live births, and in 72 of 579 live births in the treated group.

(4) No severe case occurred in either group.

(5) Cases in the treated group cleared up quicker than in the control group.

(6) In the treated group the discharge appeared early; it was largely due to reaction to the silver nitrate and was sterile.

(7) Streptomycin sensitivity was positive in all the organisms tested. Penicillin and sulphadiazine gave the worst results.

(8) It is demonstrated that the old teaching about silver nitrate is correct, but it is suggested that its use is unnecessary in a modern hospital and in a population in which gonorrhoea is rare.

I wish to thank the members of the nursing and laboratory staff of the King Edward Memorial Hospital for all the work they did in keeping the records, without which the investigation could not have been made.

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RECENT ADVANCES AND FUTURE PROSPECTS IN THE MEDICAL TREATMENT OF OCULAR HYPERTENSION*

BY

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THE question whether chronic simple glaucoma should be treated medically or by operation is still a subject of controversy.

Iridencleisis ab externo is one of the best antiglaucomatous operations. It normalizes the resistance to the aqueous flow (Weekers and Prijot, 1952b) and the ocular tension (Weekers and Heintz, 1948) in more than 90 per cent. of cases. Correctly performed, it does not involve any immediate risk; it is very rarely followed by any further complication, and stops or slows down the progress of the visual defects in almost all cases. The modifications in the metabolism of the aqueous humour resulting from the operation can sometimes hasten the evolution of a pre-existent cataract, but this complication is even more frequent after Elliott's trephine or Lagrange's sclerecto-iridectomy.

Medical treatment by parasympathicomimetic miotics does not entail a risk of cataract, though it has other serious disadvantages.

Pilocarpine does not completely normalize the resistance to the aqueous flow (Prijot and Weekers, 1952b) and leaves in the majority of cases a moderate hypertension. Its action is transient, and the study of the curves of tension shows that the instillations, even if repeated four or five times a day, do not ensure a continuous effect.

The inhibitors of the cholinesterases, such as eserine and di-isopropyl-fluorophosphate (DFP), have a more marked and more prolonged action, but they provoke a painful contraction of the ciliary muscle, and are well tolerated only by the aphakic eye.

From these considerations, it appears that surgical treatment is indicated in the majority of cases of chronic simple glaucoma, but the recent observations summarized below have encouraged us to review this important therapeutic problem.

The work of Goldmann (1949), Grant (1950, 1951), Prijot and Weekers (1952a, b) and Weekers and Prijot (1952a, b) emphasizes the importance of the hydrodynamic factors in the regulation of the ophthalmotonus (P_{oc}). This depends on the aqueous flow (Fl), the resistance to the flow in the exit channels (R), and the blood pressure in the laminar veins (Pv):

$$P_{oc}=(Fl\times R)+Pv$$

Most forms of treatment, medical or surgical, reduce the resistance to the aqueous flow, *e.g.*, pilocarpine, eserine, DFP, and iridencleisis. But it is also

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possible to reduce the aqueous flow itself, either surgically by retrociliary diathermy (Weekers and Prijot, 1952a) and cyclodialysis (Goldmann, 1951a, b), or medically by Diamox (Becker, 1952), Dibenàmine (De Long and Scheie, 1953), and adrenaline (Goldmann, 1951b).

We have studied the mechanism of hypotension during treatment with adrenaline and have found that it reduces the aqueous flow in chronic simple glaucoma (Weekers, Prijot, and Gustin, 1954). The use of adrenaline, either combined with parasympathicomimetic miotics or alone, can produce results upon the tension comparable to those obtained by surgical treatment. It is possible that in the future a combination of therapeutic methods, reducing the flow on the one hand and the resistance on the other, may lessen the need for antiglaucomatous operations.

Material, Methods, and Clinical Features

The observations recorded below have been made in cases of simple (wide-angle) untreated glaucoma. Congestive (narrow-angle) glaucoma was carefully excluded by gonioscopic examination.

The 2 per cent. adrenaline solution was made according to the following formula:†

(*i*) *Levorenine*	*2 per cent. as hydrochloride*
(*ii*) *Levorenone*	*2 per cent. as tartrate*
(*iii*) *Natr. bisulph.* (*meta*)	*30 mg.*
(*iv*) *Chlorbutol*	*30 mg.*
(*v*) *Natr. chloride*	*20 mg.*
(*vi*) *Chlor. butylaminobenzoyl*	*50 mg.*
(*vii*) *Methylphenyltrimethyl-ammoniumdodecylmethosulphate*	*1/50.000*
(*viii*) *Aqu. bidist. sterile*	*10 ml.*

Components (*iii*) and (*iv*) stabilize the adrenaline solution; components (*vi*) and (*vii*) are wetting agents.

The compression test with the electronic tonometer, which has been previously described (Weekers and Prijot, 1952a), is similar to the tonographic method of Grant (1950). The normal resistance varies from 2·7 to 7·3 mm. Hg (average 4·5).

The compression test performed on fourteen cases of simple glaucoma with moderate hypertension (less than 35 mm. Hg) shows that the hypotensive action of adrenaline is caused by a reduction of the aqueous flow. This substance normalizes the ophthalmotonus without reducing the resistance to the aqueous flow in the exit channels (Table).

TABLE

EFFECT OF ADRENALINE ON OCULAR TENSION AND RESISTANCE TO AQUEOUS FLOW

Number of Cases	Mean Ocular Tension (mm. Hg)		Mean Resistance	
	Before Adrenaline	After Adrenaline*	Before Adrenaline	After Adrenaline*
14	27	19	10	10

* Ocular tension and resistance "*after adrenaline*" measured one or two days after instillation.

† Made by Henrioul, Namur, Belgium.

Fig. 1 shows two examples of the effect of a single instillation of adrenaline. This effect lasts one or two days. Fig. 2 shows the persistence of the effect after interruption of the treatment. Fig. 3 shows two series of observations prolonged for several weeks.

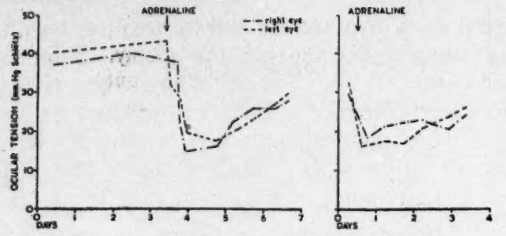

FIG. 1.—Effect of a single instillation of 2 per cent. adrenaline in chronic simple glaucoma.

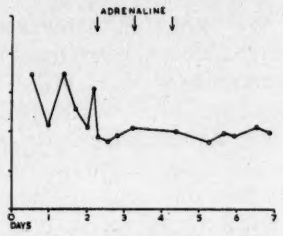

FIG. 2.—Effect of repeated instillations of 2 per cent. adrenaline in chronic simple glaucoma for several days.

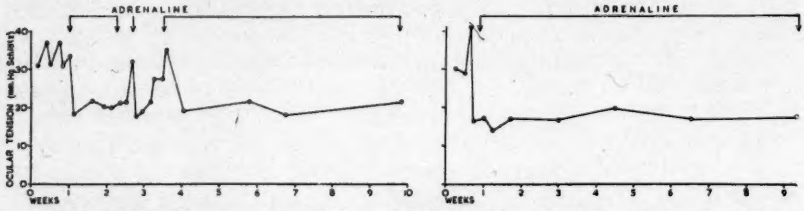

FIG. 3.—Effect of repeated instillations of adrenaline in chronic simple glaucoma for several weeks.

Discussion

The mechanism of the reduction of the aqueous flow during treatment with adrenaline is not known. Several hypotheses, none of which is satisfactory, have been discussed in a recent publication (Weekers, Prijot, and Gustin, 1954).

At present, however, adrenaline collyrium is very useful in the treatment of chronic simple glaucoma. It normalizes the tension in the majority of cases, and the effect of one instillation frequently lasts as long as 48 hours, so that the instillation of one drop every 2 days is generally sufficient.

Adrenaline provokes only a slight transient sensation of burning, and if the instillation is done in the evening, the mydriasis takes place during the night, and does not bother the patient in the morning.

Local treatment with adrenaline has no effect on the general arterial tension.

By reducing the aqueous flow, adrenaline decreases the ocular tension even when the resistance to the flow is high and irreversible and no longer reacts to the instillation of miotics.

We have now followed some of our cases for 5 months; no patient is presenting any local or general intolerance, but we do not yet know if a longer treatment will provoke reaction.

Another question is whether the reduction of the flow may not threaten the transparency of the lens. It seems that this is not so; the adrenaline reduces the flow but does not stop it entirely. It is not uncommon to observe one or more

aqueous veins, when the effect on the ocular tension is pronounced. Delmarcelle (1954) has reached the same conclusion by direct measurement of the aqueous flow. The experience of retrociliary non-perforating diathermy also shows that a reduction of the flow does not alter the crystalline lens, even after many months or years.

Sometimes adrenaline may be used with parasympathicomimetic miotics. Duke-Elder (1940) advised the use of adrenaline and eserine simultaneously. His aim was to avoid mydriasis, but this association is also justified by its double action: reducing the aqueous flow on the one hand and the resistance to the flow on the other. Our present investigations were performed with DFP which has a longer effect than eserine. In a concentration of 0·05 per cent. this substance is not easily tolerated, but it seems that very weak solutions (0·01 per cent.) are easily borne by the patient and are still efficient (Leopold, 1949; Leopold and Cleveland, 1953; Raiford, 1949). The combination of adrenaline and DFP can normalize the tension even in difficult cases of luxation of the lens, thrombosis of the central vein, exfoliative glaucoma, etc.

Treatment with adrenaline alone or in association with a miotic is contra-indicated in narrow-angle glaucoma. In those cases, the closure of the irido-corneal angle during mydriasis provokes a considerable increase of resistance to the flow, and promotes immediate hypertension. A previous instillation of DFP does not prevent the mydriasis due to adrenaline. Duke-Elder (1940) stated that:

> The action of the adrenaline group of drugs should be confined to simple primary glaucoma, their use in chronic congestive glaucoma is questionable and in acute glaucoma dangerous.

Unforeseen attacks of hypertension may be the reason why antiglaucomatous treatment with adrenaline has been given up, in spite of the good results claimed by Hamburger (1923). To-day, this complication can be avoided by gonioscopy.

We have treated forty cases of simple glaucoma without complications. A single instillation made deliberately in a case of narrow-angle glaucoma provoked an immediate and considerable attack of hypertension; it was easily neutralized by the ingestion of Diamox and the instillation of pilocarpine.

Summary

Adrenaline provides an excellent local treatment for chronic simple glaucoma and for some cases of secondary glaucoma. It is strictly contraindicated in congestive (narrow-angle) glaucoma.

Its action results from a reduction of the aqueous flow, but the mechanism of this reduction is unknown.

The association of a medication reducing the aqueous flow with a medication reducing the resistance to the flow (*e.g.* adrenaline, DFP) is followed by very pronounced effects on the tension. It is possible that in the future this combined medical treatment will reduce the necessity for surgery.

REFERENCES

Becker, B. (1954). *Amer. J. Ophthal.*, **37**, 13.
Delmarcelle, . (1954). Unpublished observations.
De Long, S. L., and Scheie, H. G. (1953). *Arch. Ophthal.* (*Chicago*), **50**, 289.
Duke-Elder, S. (1940). "Text-book of Ophthalmology", vol. 3, p. 3396. Kimpton, London.

HAMBURGER, C. (1923). *Med. Klin.*, **19**, 1224. Abs. in *Klin. Mbl. Augenheilk.*, **71**, 810.
GOLDMANN, H. (1949). *Ophthalmologica* (*Basel*), **118**, 496.
——— (1951a). *Ibid.*, **121**, 94.
——— (1951b). *Ann. Oculist.* (*Paris*), **184**, 1086.
GRANT, W. M. (1950). *Arch. Ophthal.* (*Chicago*), **44**, 204.
——— (1951). *Ibid.*, **46**, 113.
LEOPOLD I. H. (1949). *Amer. J. Ophthal.*, **32**, 579.
——— and CLEVELAND, A. F. (1953). *Ibid.*, **36**, 226.
PRIJOT, E., and WEEKERS, R. (1952a). *Ophthalmologica* (*Basel*), **123**, 1.
———, ——— (1952b). *Ibid.*, **124**, 12.
RAIFORD, M. B. (1949). *Amer. J. Ophthal.*, **32**, 1399.
WEEKERS, R., and HEINTZ, A. (1948). *Bull. Soc. belge Ophtal.*, No. 90, 494.
——— and PRIJOT, E. (1952a). *Ophthalmologica* (*Basel*), **123**, 365.
———, ——— (1952b). *Ibid.*, **124**, 166.
———, ———, and GUSTIN, J. (1954). *Ibid.* (in the press).

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CASE NOTES

CONCUSSION GLAUCOMA*

BY

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ACCORDING to Duke-Elder (1954), pathological examinations of excised eyes have been carried out and reported in only five cases of concussion glaucoma. It may, therefore, be interesting to report upon one further case of traumatic glaucoma in which the eye was excised and a pathological examination made and to compare this case with another due to a similar trauma which did not produce the same end-result, possibly owing to a difference in the method of treatment.

Case Reports

Case 1, a boy aged 10, attended on November 24, 1952, with a history of having been struck in the right eye by an arrow at 18 yds range, some 24 hrs previously.

Examination.—In the right eye a hyphaema occupied half the anterior chamber. The part of the iris which was not covered seemed normal. The fundus was not visible.

The patient was admitted to hospital, and treated with gutt. atropine 1 per cent. and vitamin K by mouth. Two days later the hyphaema suddenly became complete, and the intra-ocular tension was raised (++). The eye was treated with ice-packs.

December 18, 1952.—Tension was still raised (+). There was blood staining of the cornea, but the eye was not painful. He was discharged to attend the out-patient department, and was seen on several occasions without much change.

January 19, 1953.—He attended with a history of having sustained a fresh blow on the right eye from a boy's fist 4 days earlier. The tension was +++. The eye gradually settled down.

May 12, 1953.—He was seen by Mr. Keith Lyle who reported as follows:

> This boy has had a serious injury to his right eye which has resulted in blood staining of the cornea with new vessel formation and severe damage to the iris, which has become atrophic, leaving only a small cystic swelling on the outer side. He also has a traumatic cataract.
>
> I think that, at this stage, a discission of the right lens should be carried out, in order to get rid of the cataract. It is a complicated case, and I do not think that one can do more than hope that the eye will be able to perceive large objects.

June 20, 1953.—Right needling was carried out; this was repeated on June 4. These gave a good aperture and the eye was quite satisfactory, until some 3 weeks later it became painful again with another hyphaema and tension was again +. This attack was thought to be due to another blow, but no positive evidence could be obtained.

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The eye began to settle, but in September, 1953, the left eye became irritable, and the monocyte count became raised (on Sept. 14 monocytes formed 5 per cent. of a total white blood count of 7,900, and on Sept. 25 they formed 8·5 per cent. of a total white blood count of 10,650). It was, therefore, decided to excise the right eye, and this was done on October 3, 1953. The left eye has since remained normal with visual acuity 6/5.

The following report on the specimen was received from the Institute of Ophthalmology:

> On one side of the section there is evidence of a healed perforating wound of the extensively scarred and vascularized cornea near the limbus, the inner aspect of which is adherent to an organized inflammatory tissue covering the anterior surface of the iris. Descemet's membrane appears to be ruptured. The filtration angles on the other side of the section are also occluded by the formation of broad peripheral anterior synechiae, and posterior synechiae have formed between the degenerate iris remnants and the remains of the cataractous lens. There is free haemorrhage in the posterior chamber in association with a fine cyclitic membrane. A mild and focal chronic inflammatory infiltration is present in the uveal tract. The retina is oedematous and the retinal ganglion cell layer and optic nerve show early atrophy and gliosis. The sections examined show no histological evidence of sympathetic ophthalmitis. Secondary glaucoma. Traumatic cataract. Operation. Chronic endophthalmitis.

Case 2, a boy aged 6, attended the out-patient department on April 26, 1954, with a history of having been struck in the left eye by an arrow on April 18. His own doctor reported that there was, at the time, some oedema of the left upper lid and some conjunctivitis. On April 23. he attended his own doctor again with a history of having vomited several times during the previous 2 days; at this time "the eye did not appear much worse". He was later referred to the out-patient department as "he was not eating and not sleeping".

Examination.—There was a total hyphaema in the left eye. The tension was +++. The patient was admitted to hospital and treated with ice-packs applied to the left eye, gutt. atropine 1 per cent., and vitamin K by mouth.

April 27, 1954.—Hyphaema absorbed but tension still +.

April 29, 1954.—Tension still +, gutt. eserine ¼ per cent. 4 times daily prescribed.

May 2, 1954.—Tension normal, pupil contracting well and eye quiet. Discharged to out-patient department.

May 10, 1954.—Visual acuity was 6/24 in the left eye. As the fundus was not visible, examination was done under homatropine and cocaine. Full dilatation of the pupil was obtained. A vitreous haemorrhage was discovered, and this was confirmed by slit-lamp examination.

May 31, 1954.—Tension still normal. Visual acuity was 6/12 in the left eye; the vitreous was clearing in the upper half and the fundus appeared normal in that area.

Comment

In both cases, the affected eye had been struck by an arrow. In the first, glaucoma occurred on the third day, and, in the other, one can only presume that the rise in intra-ocular tension occurred on the third day also, being the cause of the attacks of vomiting. The cause of glaucoma, in both cases, was intra-ocular haemorrhage though no evidence can be adduced as to how these haemorrhages acted. What is certain about the second case is that there can have been no predisposition to glaucoma in this eye. The

pupil was fully dilated with homatropine and cocaine 4 weeks after the accident, without any rise in tension.

Section of the excised eye has not helped in elucidating the mode of action of intra-ocular haemorrhage in the production of the glaucoma in this case, although it is apparent that the recurrence of glaucoma in September, 1953, was due to blockage of the filtration angles by broad peripheral anterior synechiae, and it may be assumed that the original haemorrhage into the anterior chamber blocked the filtration angle in a similar way.

These two cases show that miosis may be more useful than mydriasis in the treatment of concussion glaucoma, though the evidence is inconclusive.

Summary

Two cases of concussion glaucoma due to trauma by arrows have been described. The common feature was the total hyphaema. The eyes took different courses, possibly because a miotic was used in the second case.

REFERENCES

DUKE-ELDER, S. (1954). "Text-book of Ophthalmology", vol. 6, p. 5887. Kimpton, London.

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SUBCONJUNCTIVAL LYMPHOMATOUS TUMOUR*

BY

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IN his review of orbital tumours based on autopsy material, Forrest (1949) puts the proportion of lymphomata or lympho-sarcomata at about 10 per cent. Yet the disease does not often present in the first instance to an ophthalmologist. Schultz and Heath (1948), in a series of 1,600 cases of lymphomatous tumours of all varieties, found that only 3·1 per cent of them were of orbit or conjunctiva only. This insignificant percentage may perhaps be explained by the fact that, as Wolff (1948) pointed out, "no real lymphatics have as yet been demonstrated in the orbit", though there are conjunctival lymphatics which . . . . "drain towards the commissures where they join the lymphatics of the lid". McGavic (1943) collected a series of 21 lymphomatous tumours presenting solely in the region of the eye; five of the 21 were "subconjunctival", like the case described below, seven were in the lacrimal gland, three in the orbit, and five in the lid and brow, and one was intraocular (in the iris).

The following case may therefore be of interest, as it is typical in appearance, and in age of onset, and also in its undoubted radio-sensitivity.

Case Report

A woman aged 73 attended complaining of a painless mass under the eyelid of about 6 months' duration and visible to herself for 2 or 3 weeks. She was a big built woman from a country district, and had no other pains or symptoms. There had been no trauma and no preceding illness. A clinical search for enlarged lymph-glands, liver, or spleen, and for surface signs of neurofibromatosis was negative.

Laboratory Findings.—Mantoux and Kahn tests negative.

X ray of the orbit of mediastinum clear. Blood-Count, erythrocytes 4·4 million per c.mm., haemoglobin 88 per cent., colour index 1·0, leucocytes 4,000 per c.cm., neutrophils 62 per cent., large mononuclears 4 per cent., lymphocytes 34 per cent.

The tumour rested in the upper fornix, and was fleshy and of elastic, solid consistency, with smooth conjunctiva over it (Fig. 1). It caused no proptosis nor injection of the eye. The upper eyelid bulged forward (Fig. 2), and eversion showed that the lid itself was free and the palpebral conjunctiva normal. As is shown in Fig. 3, the tumour overhung the upper edge of the cornea. The visual acuity was 6/9 in each eye with correction, and with the exception of slight asteroid vitreous opacities the fundi and media were clear. No definite diagnosis was established before biopsy. Local excision of the tumour was performed on December 6, 1951, and, as the mass appeared to be localized to the surface, no attempt was made to explore the orbit more deeply.

*Received for publication March 23, 1954.

FIG. 1.—Tumour in upper fornix.

FIG. 2.—Displacement of upper eyelid.

FIG. 3.—Tumour overhanging upper cornea.

Pathology.—The report from the Department of Pathology of the Institute of Ophthalmology (Fig. 4) was as follows:

Section shows a partially encapsulated tumour, composed of small lymphocytic cells with a minimum of cytoplasm and round reticulated nuclei. There is little connective tissue stroma, but the growth is permeated by a network of well-formed fine capillaries. Haemorrhage and cellular necrosis are evident. This is a lymphomatous tumour, but it is not possible from the histological picture alone to be certain whether it is a benign lymphoma, lymphosarcoma, or lymphatic leukaemic infiltration. A general physical examination, with particular reference to the lymphatic system, and a complete blood-count, may prove of value. The growth reaches to the limits of the biopsy and has probably not therefore been completely removed. Lymphomatous tumour of the orbit.

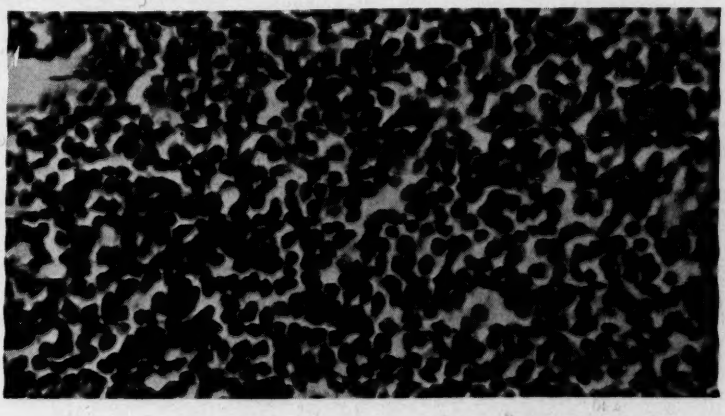


FIG. 4.—Section of lymphomatous tumour. ×510.

Radiotherapy.—In view of this report, the patient was seen in consultation by Dr. Nuttall and 5 weeks after the excision *x*-ray therapy was given locally by his department. This

consisted of a single treatment of superficial *x* ray, of 80 KV 1,200r on January 14, 1952, done with a 3 cm. circle straight into the orbit.

It is now 3 years since the appearance of the tumour, and 2½ years since it was excised. There has been no local recurrence nor involvement of the eye, which retained corrected visual acuity of 6/12, until this year (1954), when it deteriorated to 5/60 on account of a posterior polar cataract. The patient remains in excellent general health, and her weight is unchanged. Clinical examinations at intervals have so far shown no palpable lymphatic adenopathy, and no enlargement of liver or spleen. *X*-rays of the chest have shown no evidence of enlarged mediastinal glands nor atelectasis. The blood picture remains unchanged, the most recent report (June 30, 1954), showing:

Red blood cells 4,300,000 per c.mm., normal in morphology and distribution, haemoglobin 88 per cent., colour index 1.0, white blood cells 4,000 per c.mm., normal in number, morphology, and distribution, neutrophils 60 per cent., large mononuclears 12 per cent., lymphocytes 28 per cent.

Discussion

The recent literature on lymphomatous tumours presenting in the orbit or subconjunctiva seems to point to a relatively good prognosis, with prompt *x*-ray therapy, so long as signs of remote disease are not already evident. Wintrobe (1946) says that the case with the most favourable outlook is perhaps the one with only one accessible node-group involved, no deep adenopathy, and no systemic symptoms. Feinstein and Krause (1952) deduce from their series that:

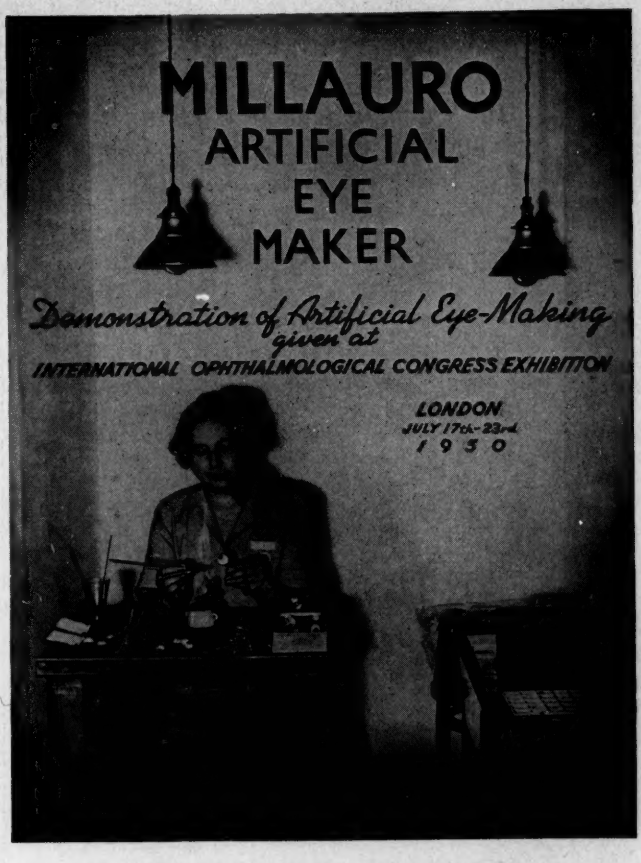
> It is apparent in twelve of the eighteen cases that if the disease was going to strike at the extra-ocular axes, it did so within 1½ years from the onset of the initial lesion.

Schultz and Heath (1948), say that, in their eight cases in which the lymphoma was localized to the conjunctiva when first seen without signs elsewhere, there was no recurrence, local or remote, after treatment over periods of from 2 to 5 years. But, of six cases in which remote disease was evident concomitantly, all but one promptly succumbed despite treatment. They say the ultimate prognosis is grave in any case but that . . . " an unusually long period of remission may be expected if the disease is confined to the conjunctiva". They quote cases of patients who have remained well for 11 and 19 years after excision and *x*-ray therapy. Of twenty cases of lymphomatous tumour about the eye reported by McGavic (1943), all being verified by biopsy, seventeen presented without any generalised involvement, and of those, fifteen were alive after a follow-up averaging 4 years, eleven without and four with generalized spread. McGavic says a long survival rate is largely dependent on the treatment of the disease while it is still localized, but that extending his follow-up period might modify the prognosis. Of the five cases which presented subconjunctivally, all except one were alive and well 2 to 4 years after treatment.

I am indebted to Dr. Norman Ashton, Director of the Department of Pathology of the Institute of Ophthalmology, University of London, for permission to quote the report on the histopathology, and for the photograph of the section, and to Dr. Nuttall, Deputy-Director of Radiotherapy, Leeds, for the radiotherapy of the case, and his permission to quote details of the dosage used.

REFERENCES

FEINSTEIN, A. R., and KRAUSE, A. C. (1952). *Arch. Ophthal.* (*Chicago*), **48**, 328.
FORREST, A. W. (1949). *Ibid.*, **41**, 198.
MCGAVIC, J. S. (1943). *Ibid.*, **30**, 179.
SCHULZ, M. D., and HEATH, P. (1948). *Radiology*, **50**, 500.
WINTROBE, M. M. (1946). " Clinical Hematology ", 2nd ed., chap. 18. Kimpton, London.
WOLFF, E. (1948). " The Anatomy of the Eye and Orbit ", 3rd ed. Lewis, London.



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Brit. J. Ophthal. (1954) **38**, 753.

HYDATID CYST OF THE ORBIT*

BY

M. MAZHAR

Civil Hospital, Aden

HYDATID cysts are not uncommonly localized in the eye and its appendages, but their occurrence in the conjunctiva is rare (Duke-Elder, 1938, 1952; Walsh, 1947). As far as I could find in the literature none has been reported in Arabia. Only two cases have been seen in Aden in 17 years.

Case Reports

Case 1, an Arab female aged 35, attended the out-patient department complaining of loss of vision in the left eye for the past 3 months. The globe was partially shrunken. The left upper lid looked fuller and was less mobile than the right. On lifting the lid one could see a small cystic tumour-like mass in the upper temporal quadrant of the orbit.

The patient gave no history of trauma or pain in the eye, and on account of this vague history it was difficult to decide the cause of the loss of sight. My first impression was that this was a case of sarcoma of the choroid which had spread outside the globe. The conjunctiva was as normal as in the other eye. The diagnosis of hydatid cyst did not suggest itself, but as the eye was blind I decided to enucleate the remains. It was at once obvious that the cyst was quite separate from the globe. The cyst was very tense and circular in outline, and, while dissection was being attempted, it ruptured and the diagnosis of hydatid was at once apparent. It was confirmed microscopically as one could see many scolices and hooks from the cyst wall. There was a certain amount of reaction due to the rupture of the cyst into the tissues but this subsided in due course.

Case 2, an Arab female aged 35, came to the out-patient department complaining of proptosis in the right eye, without much pain, of 2 months' duration. The proptosis was forwards and downwards. The vision in the eye was reduced to finger counting. A tumour could be palpated through the upper lid and seemed to be cystic in nature. The upward movement of the eye was limited. The blood count showed an eosinophilia of 5 per cent. A tentative diagnosis of hydatid cyst of the orbit was made as this patient arrived just after the discharge of Case 1. I aspirated a small amount of the fluid in the cyst and the laboratory tests confirmed the diagnosis.

It was decided to remove the cyst and a direct cutaneous approach was chosen. The cyst was exposed, and to reduce its size a small amount of fluid was aspirated. Dissection was difficult as the cyst was deep in the orbit, and it ruptured before it could be removed. The wall of the cyst was removed entire and the wound closed in layers. Leakage of the cyst fluid caused severe local reaction, and 15 days after the operation the patient suddenly complained of severe pain in the eye. Chemosis of the conjunctiva, oedema of the cornea and a hypopyon were present, and in spite of all attempts to prevent it, panophthalmitis developed, and the eye had to be eviscerated, after which the trouble quickly subsided.

Fluid aspirated from Cyst	*Differential White Blood Cell Count*		
Proteins.—Present in very small amount	polymorphs	37	per cent.
Sugar.—55 mg./100 ml.	lymphocytes	55	
Urea.—Less than 15 mg./100 ml.	monocytes	3	
Chlorides.—Abundant	eosinophils	5	

Under the microscope many scolices were seen in the aspirated fluid. No morbid histological examination was possible.

REFERENCES

DUKE-ELDER, S. (1938, 1952). "Text-book of Ophthalmology", vols 2 and 5. Kimpton, London.
WALSH, F. B. (1947). "Clinical Neuro-Ophthalmology". Williams and Wilkins, Baltimore.

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FOREIGN BODY IN THE NOSE SIMULATING ACUTE DACRYOCYSTITIS*

BY

J. GIBSON MOORE

London

FOREIGN bodies in the nose are well known in ear, nose, and throat clinics; they are more common in children in whom they are usually self-introduced.

In this case it would appear that a man aged 71 years tolerated a foreign body two inches long for 10 years until it caused a discharging sinus below the right eye and he was forced to obtain medical advice.

Case Report

The patient first attended on July 17, 1953, when he gave history of a fall on his face about a month previously, since when he had noticed a discharge below the right eye. There was no history which might lead to suspicion of a nasal disorder and it was only on questioning at a later date that he said that the right nostril had been blocked for many years. On examination he had a sinus below the right inner canthus and the appearance was quite typical of an acute lacrimal abscess which had recently burst. He was given intramuscular injections of penicillin 300,000 units twice daily for 4 days and the condition settled satisfactorily.

He attended again October 22, 1953, with a recurrence, and, as there was no reason to suppose that this was not an acute dacryocystitis, it was decided to remove the sac. At operation, when the sac had been removed and the lacrimal fossa was bared, it was noted that there was a small hole in the lacrimal bone exuding pus and presumably communicating with the nose. It was only then seen that the trouble was due to some nasal abnormality.

The presence of a large foreign body was revealed by *x* ray (Figs 1 and 2) and this was later removed by Dr. Arciszewski.

The foreign body (Fig. 3) was clearly a catheter spigot and the incrustations seen beside it in the photograph give some indication of the prolonged period of impaction. It was, of course, interesting to try to discover how it could have entered the nostril apparently unknown to the patient. He did not appear to be a psychiatric case who might have placed it there himself for some reason, but he had extremely capacious nostrils and it was easy to see that the spigot had a very roomy resting place. He volunteered the suggestion that it had been placed there by the Nazis before the War when he was persecuted for his religious beliefs, but this seems an unlikely explanation. He had had investigations in two different London hospitals in 1942: the first for the possibility of gastric ulcer and the second for cystitis. It is just conceivable that a Ryles tube might have been closed by a spigot and that the tube might have slipped down pulling the spigot up the nose. He might even had done this himself when half asleep. It is more difficult to conjecture how a spigot used for bladder catherization could have entered the nose but these were the only relevant incidents that he could give.

*Received for publication May 10, 1954.

FIG. 1.—Catheter spigot impacted in the nose.

FIG. 2.—Lateral view of Fig. 1.

Discussion

It is easy to be wise after the event, and undoubtedly an earlier *x*-ray and reference to one's E.N.T. colleagues would have saved this patient some discomfort and perhaps a dry eye, although the latter is doubtful as, at operation, the lacrimal sac appeared to be largely destroyed. The question of routine E.N.T. examination is of doubtful value in cases of chronic or acute dacryocystitis. In the case of the former condition, such an authority as Traquair (1941), considering operation for epiphora, states that in no case (out of 548) was a preliminary rhinological examination taken, and that nothing was found during operation or later to indicate that the treatment would have required

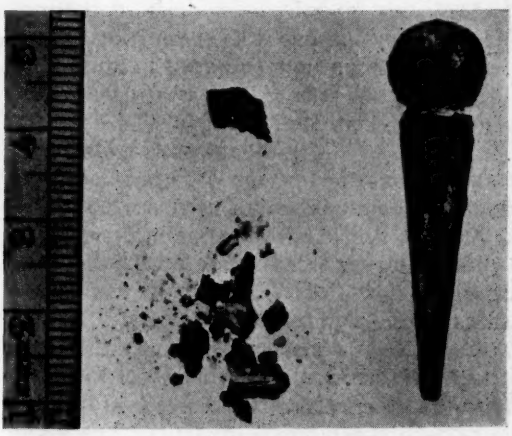

FIG. 3.—Spigot after removal. Note incrustations corroborating the 10-year history of impaction.

modification or that the results would have been different had such an examination been made. Presumably this will also be true for the acute dacryocystitis, which normally follows the chronic stage. There is always the possibility of an extension from an infected ethmoid or frontal sinus causing confusion, but here the maximum swelling is usually above the internal palpebral ligament while in the case quoted above the fistula was in the " classical " position below it.

Summary

A case history is presented of a foreign body 2″ long in the nose which seems to have been present for 10 years and caused erosion of the lacrimal fossa simulating an acute dacryocystitis.

My thanks are due to Dr. Arciszewski, registrar, to Mr. J. N. Deacon of Edgware General Hospital, and to Miss Shaw who took the photographs.

REFERENCE

TRAQUAIR, H. M. (1941). *Arch. Ophthal. (Chicago)*, **26**, 165.

Brit. J. Ophthal. (1954) **38**, 757.

APPLIANCES

NEW ELECTRODE TRANSILLUMINATOR*

BY

A. H. OSMOND

Worthing and Brighton

THE classical operation for retinal detachment, although giving an 80–85 per cent. success rate in skilled hands, appears to have one uncertain feature, namely, the ability of the surgeon to place the diathermy electrode exactly on the point of the sclera corresponding to the hole in the retina.

To achieve this, one has been taught to think in terms of meridians and optic disc diameters, and then, by making a tentative "shot" with the diathermy, to look and see if the answer to the calculations is anything like right (Gonin's method). Textbooks make this sound easy, and so indeed it may be, provided the diathermy has made a mark on the retina which is easily recognizable. But so often it has not, either because the current at the electrode was not sufficiently great, or because there was too much intervening fluid for the retina to show coagulation.

It would be helpful to have a really positive method of marking on the outside of the sclera the exact position of a retinal hole or tear within, and to this end I have reviewed the methods used by surgeons in Britain and elsewhere. The earlier ones, summarized by Duke-Elder (1934), all depend fundamentally upon the estimation of meridian and latitude. They include the perimetric methods of Lindner (1929) and Klein (1933), the tangential projection method of Cowan and McAndrews (1931), the "thread" method of Imre (1930), and that of Weve (1931), which depended upon the projection of the retinal hole upon an artificial eye. To these must be added the "stud" method of Foster Moore (1931), and that advocated by Vogt (1936), which depended on the production of hydrogen bubbles round a perforating electrode.

None appears to offer a completely satisfactory solution to the problem; some because they require elaborate apparatus and others because they depend upon perforating the globe, which not only causes additional trauma, but also makes subsequent diathermy on a collapsed eye much more difficult.

The new method of Weve (1940) and Arruga (1936) is a very different matter. The hole is located by indirect ophthalmoscopy, using an extremely powerful light, and the sclera is marked with Chinese ink at the point where the light is seen by translucence. It seems that this is certainly the best method in use to-day, as it provides a way of marking the sclera which is quick and accurate in skilled hands.

*Received for publication May 10, 1954.

But many of us, either because we have not been brought up in the continental tradition, or because we are too lazy to learn, find it difficult to use indirect ophthalmoscopy with the facility of the direct method. We are not happy because the image is much smaller and the picture inverted, there are more disturbing light reflexes, and it is much more difficult to keep everything still when working at arm's length; the search for a small hole or slit in the folds of a detached retina can become an exceedingly difficult procedure, and one's frustrated emotions alternate between admiration for the brilliance of one's fellow men and a deep conviction of personal incompetence.

A search was made for yet another method, and an idea germinated during an operation for the removal of an intra-ocular foreign body by the posterior route. The foreign body—a small piece of steel—was seen to be lying on the retina near the 7 o'clock meridian just behind the equator, but to study it more closely I introduced a transilluminator behind the eye and watched the result with an ophthalmoscope. The transilluminator was a powerful 12-volt model and produced a light which was rather too bright for comfort, but I was surprised at the ease with which one could steer the shining patch behind the foreign body, which stood out in stark silhouette against the network of the choroidal vascular bed.

It was then apparent that the tip of the transilluminator was exactly on that part of the sclera which would have to be incised if the foreign body were to be removed with a minimum of vitreous disturbance, and the great desirability of having some reliable means of marking it became evident. The marking could not be done with ink as the tip of the transilluminator was out of sight and some way back between Tenon's capsule and the sclera, and there was nothing for it but to draw the eye upwards and take the transilluminator with it, hoping that there had been no relative shift in the meantime.

It will be realized at once that this was a difficult and unsatisfactory thing to do, as the sclera was slippery and the transilluminator heavy, and it was not possible to be sure that movement had not taken place.

Various ideas were considered, and the answer seemed perhaps to lie in diathermy. Would it be possible to combine a transilluminator with a diathermy electrode in such a way that they could both exert their influence at the same point? It seemed that if one were in the form of a small ring round the other, the effect would be practically the same, and no less efficient. Moreover, such an instrument could be used in cases of retinal detachment, thus opening for it a much larger sphere of usefulness.

It seemed at first that it would be best to have a central electrode surrounded by a small but intensely powerful ring of light, but for technical reasons this proved impossible to arrange. A prototype model has now been constructed* with the alternative arrangement of a central light surrounded by a ring electrode, the whole measuring not more than 3 mm. in diameter.

*By C. Davis Keeler, 39 Wigmore Street, W.1.

I found, however, that I was not the first in the field with these ideas, as Summers (1945) had devised an instrument working on the same principle for dealing with holes at or near the macula. This had been adapted from the Clegg transilluminator, but the hole through which the light emerged was surrounded by a small ring electrode. The hooded light itself was passed round behind the eye, and the resultant luminous patch was viewed with an ophthalmoscope. The Summers instrument was found very difficult to use, however, chiefly on account of the diffusion of the light from such a small source, and it therefore seemed imperative to find a way of increasing the intensity of the light and if possible to give it focal qualities, so that it could penetrate the sclera and sub-retinal fluid with minimal dispersion. Such a light would be too large to be passed behind the eye, and once again the transilluminator cone seemed to provide the answer.

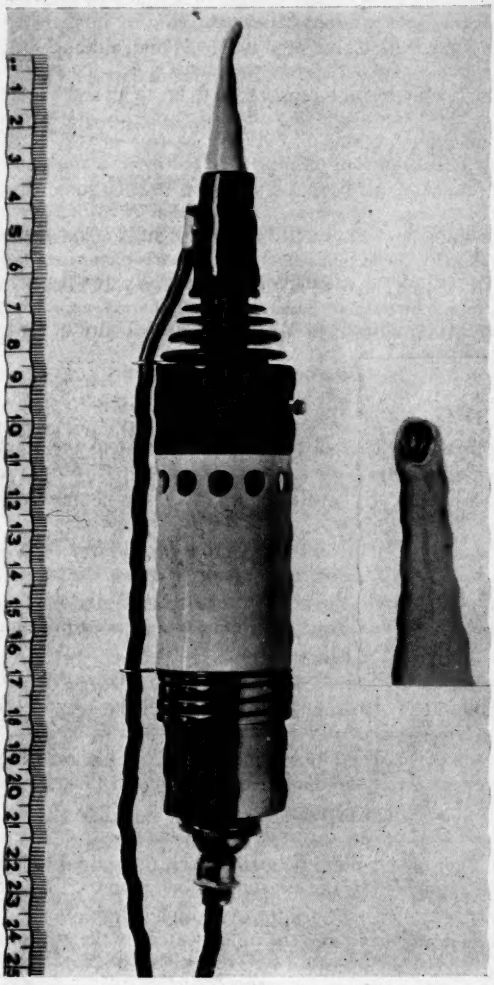

FIGURE.—Transilluminator electrode.
(*Inset*)—Magnified view of tip, showing ring electrode.

Description of the Instrument

The handle, containing the 12-volt light, iris diaphragm, and condensing lens, is the same as that supplied for the Keeler "Continental" ophthalmoscope. It carries a series of cooling fins which are particularly valuable, since the instrument must be held in the hand for some time at operation, and if covered with a sterile cloth is apt to become uncomfortably hot.

The new part of the instrument is the transilluminator cone (*Figure*). This has a superficial resemblance to a normal standard transilluminator cone with the end bent over at an angle, but it is different in that it is covered first by metal and then by a plastic material. The metal encases the entire cone of trans-

parent plastic except for the tip, where it forms the ring electrode round the light, and there is a circular fenestration at the base through which the light passes into the cone from the handle. The cone is detachable for sterilization, by a quick-run metallic screw thread, and the diathermy current is passed through this connection to the ring electrode at the tip.

The plastic outer covering of the cone is of opaque cream-coloured material, and completely envelops the metallic layer, apart from the ring electrode and the screw thread at the other end, thus providing an effective insulation between the metallic covering and the ocular tissues.

In the neck of the handle is an insulated brass collar, threaded internally to take the base of the cone, and the main diathermy lead is directly attached to it.

The function of the iris diaphragm is twofold. It has been suggested that, although it is easy to see the position of the transilluminated light when the retina is flat, the case is different when it is detached and there is a layer of sub-retinal fluid to break up and scatter the rays; that, in fact, all one would be able to see would be a diffused glare without obvious boundaries and certainly with no discernible centre. This may be true in very large detachments, and especially in those associated with haemorrhage but in detachments of "normal" size—which are more probable if the patient is rested in bed for some days before operation—this is certainly not the case. However, it is a fact that by cutting down the intensity of the light in the transilluminator the central point of light can sometimes be seen with even greater distinctness, and it is on this account that the iris diaphragm has been included in the instrument. In practice, an assistant would normally dim the light by the rheostat on the transformer box or control panel of the diathermy apparatus, but in cases where the transilluminator is run directly from a 12-volt accumulator or other supply, the iris diaphragm would be indispensable.

The second reason why dimming is desirable is shown below.

Technique of Use

The description given here applies to a case of retinal detachment in the right eye where the hole is in the upper quadrant of the retina. The essential technique is the same for either eye and for a hole in any position, and it is a simple matter to adapt it accordingly.

The preliminaries of the operation are identical with routine procedure. These include a meticulous examination of the fundus, a drawing to show the salient features of the detachment and the position of the hole(s), rest in bed for some days with the eyes covered to aid absorbtion of subretinal fluid, and the greatest possible mydriasis and retrobulbar anaesthesia at operation.

If it is thought necessary to divide the superior rectus, a suture is passed through its insertion to control the movement of the eye, and the sclera over the area of the hole is carefully and completely cleaned. Absolute haemostasis and a dry sclera are even more important than in the normal operation, as any dampness will seriously interfere with the proper action of the diathermy. Points of recalcitrant bleeding are stopped by a touch of a heated probe.

The electrode transilluminator is held upside down in the left hand with the light off, and the tip is placed on that part of the sclera beneath which the retinal hole is thought to lie; the eye is then rolled upwards by the assistant drawing on the traction suture, and the transilluminator is taken with it until the eye is in a suitable position for ophthalmoscopy. The theatre is darkened and the hole located by the ophthalmoscope, held in the right hand, in the usual way.

The hole, of course, appears red against the surrounding greyness of the detachment, but with the transilluminator it appears greyish yellow against a light pink

background, and it is sometimes difficult to " pick up " a hole with the transilluminator after viewing it with the ophthalmoscope. It is therefore important that the ophthalmoscope light should be gradually dimmed while that of the transilluminator is slowly brought up, so that the light is handed over, as it were, from one to the other. In this way there is less risk of losing the hole, and it is then a simple matter gently to move the transilluminator until the brightest part of the light coincides with the hole, and so to press the foot switch.

The diathermy exposure required to produce an easily recognizable mark will be found to be greater than usual. Even with a perfectly dry sclera, some 10–12 seconds at 100 ma. will be necessary. This is because the ring electrode, being of greater surface area than normal, spreads the current and makes it less effective. However, this hardly matters; the essential purpose of the ring electrode is to act as a marker, and the mark, once made, can be extended radially with a normal electrode until a sufficiently large " coagulation bed " is thought to have been prepared. If the hole is large, two or more marks can be made with the ring electrode to map out the boundaries, and the accuracy with which this can be done after a little practice is most satisfying.

The operation is completed in the usual way by drainage of the sub-retinal fluid, injection into the vitreous (as is my practice) of 1 ml. sterile air, reapposition of any divided muscle, and closure of the conjunctiva.

Discussion

It may be suggested that, owing to obliquity of the rays and the refractive effect of the sub-retinal fluid, the point marked on the sclera will not correspond with the position the hole will occupy when the retina is replaced, and this argument is valid where large balloon detachments have not subsided with pre-operative rest; but with lesser detachments the error is, I think, negligible. The mark will lie inevitably on the exact meridian of the hole, and if the diathermy reaction is extended towards the limbus, any slight error in that direction will be allowed for.

It is interesting to reflect, also, that if this criticism is valid, it is equally so when the hole is located by indirect ophthalmoscopy and the sclera marked with ink, since the passage of the light rays is identical, although reversed in direction. As Weve (1940) admits, when discussing balloon detachments:

> Should the surgeon deal with the tear, he has to remember that with superficial coagulation the attached tear moves one or even several millimetres more peripherally from the position shown by transillumination.

It is believed that this instrument, if used as described above, will furnish a ready means of marking the position of holes in retinal detachments. It is not difficult to use, and I am satisfied that the position of the hole makes little difference to the technique. When Majewski and Comberg (1930) suggested localization by a transilluminator, it was thought that since the eye must be turned in opposite directions to apply the transilluminator and to view the hole with an ophthalmoscope, such a method would be impossible, but this is not so; provided the sclera has been cleaned and dried beforehand, the tip

of the electrode transilluminator can be passed backwards between the globe and Tenon's capsule, and the eye can then be placed in the best position for ophthalmoscopy.

Summary

An account is given of the difficulty of localizing on the sclera the position of an intra-ocular foreign body, or of a tear or hole in retinal detachment.

A comparison is made of the accepted ways of dealing with this and the conclusion drawn that none is really satisfactory.

A new type of combined transilluminator and diathermy electrode is described, and the technique of its use explained.

I should like to thank my colleagues at the Sussex Eye Hospital, Brighton, for their interest in the production of this instrument and for several valuable suggestions, to Mr. Charles Keeler for his unfailing courtesy, and to Mr. Jackson of the Royal Sussex County Hospital for the photographs.

REFERENCES

ANDERSON, J. RINGLAND (1931). " Detachment of the Retina ". University Press, Cambridge.
ARRUGA, H. (1936). " Detachment of the Retina ", trans. R. Castroviejo. Westermann, New York.
COWAN, A., and MCANDREWS, L. F. (1931). *Arch. Ophthal. (Chicago)*, n.s. **5**, 760.
DUKE-ELDER, S. (1934). " Recent Advances in Ophthalmology ", 3rd ed., chap. 10. Churchill, London.
IMRE, J. (1930). *Ber. dtsch. ophthal. Ges.*, **48**, 321.
KLEIN, M. (1933). *British Journal of Ophthalmology*, **17**, 145.
LINDNER, K. (1929). *Klin. Mbl. Augenheilk.*, **82**, 119.
MAJEWSKI and COMBERG (1930). *Klin. Oczna.*, **8**, 68.
MOORE, R. FOSTER (1931). *British Journal of Ophthalmology*, **15**, 545.
SUMMERS, T. COLLYER (1945). *Brit. med. J.*, **1**, 48.
VOGT, A. (1936). *Schweiz. med. Wschr.*, **17**, 593.
——— (1937). *Zbl. Ophthal.*, **37**, 161.
WEVE, H. (1931). *Klin. Mbl. Augenheilk.*, **87**, 145.
——— (1940). *In* " Modern Trends in Ophthalmology ", 1st series, ed. F. Ridley and A. Sorsby, chap. 50. Butterworth, London.

Brit. J. Ophthal. (1954) 38, 763.

A SYMPOSIUM ON GLAUCOMA

MOST medical people have been to many professional meetings ranging in size and importance from the meeting of the local society to the monstrous and multilingual international congress; but few have been to a meeting of greater professional or scientific value than the Symposium organized by the Council for International Organizations of Medical Sciences, held in Canada in September, 1954, on the subject of Glaucoma. The function of such a symposium is well defined. It should concern itself with a relatively small subject which is going through a period of rapid evolution, preferably a subject which different workers in different countries are approaching from different aspects. It so frequently happens that the methods and conclusions of workers in unrelated disciplines are not understood or are misinterpreted by those whose training and habit of thought have been on other lines; the clinician, for example, fails to understand the language of the chemist or the physicist in papers which may be highly technical, and therefore does not derive the help from him that he might. The ideal subject for a symposium is one to which contributions are being made from many angles, and the ideal participants those who would not normally meet unless special facilities were made available.

The subject of this symposium was glaucoma, on which a vast amount of research has recently been done in several countries in Europe and America. At the meeting there gathered from different countries in the world a physiologist, a biochemist, a pharmacologist, and a pathologist, as well as a number of workers engaged on active clinical research on the problems presented by this disease, all of whom had a right to be heard by reason of the excellence of their researches; these were confronted by a number of senior clinicians, surgeons and physicians, with long experience of the practical problems which abound in this disease. There is always a danger that new knowledge may be given a disproportionate importance by the generation which is thrilled by it, and it is often some time before it sinks into its proper perspective in the mass of the old and proved knowledge gathered by previous generations. There is also the danger that in a problem of this sort those actively engaged may be mesmerized by the exciting possibilities of new techniques—that the biochemist, for example, will see the whole answer to a clinical question in his laboratory studies, or that the gonioscopist will confine his reasoning to one particular aspect of clinical investigation. When these various specialists meet and argue amongst themselves a sense of proportion emerges. The

clinician learns to appreciate the value and, what is more important, the limitations of the laboratory studies with which he may have been so impressed hitherto that he had accepted them without criticism; the laboratory worker learns to appreciate the variability of biological material and the complexity of clinical problems, and, at the same time, can assess the aspects of his work which are of practical importance.

The subject of the present symposium was ideal for such a meeting; the problem presented by the normal and abnormal intra-ocular pressure has recently been approached from many angles—the biochemistry of the aqueous humour, the vascular pathology of the eye and particularly of its drainage channels, the pharmacology of the many drugs, old and recent, at present employed in therapeutics, while many important new clinical methods of investigation—gonioscopy, tonography, fluorometry, and so on—have been applied to the study of the disease. During the last decade many of those engaged on these investigations appear to have been contradicting each other, so much so that it was commonly said that there was an " American school " and a " European school " of thought on the matter. The symposium made it abundantly clear that this distinction did not in fact exist; differences in approach and in the technicalities of language accounted for differences in view-point which were discovered to be more apparent than real. In the discussion most of these divergences were ironed out and the participants understood that in the fundamental facts they were all in essential agreement and had been so all the time. Most of the general conclusions reached at the meeting were unanimous; the most important thing that emerged was that definite lines of presumptively fruitful research were laid down for the future in which it is confidently expected that the various contributors to the symposium will happily collaborate.

From the technical point of view, the first essential of a symposium is that the meeting be kept relatively small; it should be conducted so that all inhibitions are lost and argument is free and untrammelled. This implies considerable technical help. In this symposium, as in other symposia conducted by the C.I.O.M.S., the papers were distributed previously so that all the participants were acquainted with what each contributor proposed to say, and the plan was adopted that each paper was merely summarized with the main points emphasized; much more time was therefore available for the discussions. These were tape-recorded and the record of each session distributed in typescript among the participants for correction before their final condensation and editing for publication in due course.

The participants in this Symposium on Glaucoma were well known to each other by their writings and reputations, although all were by no means personally acquainted. They formed a very happy family and the atmosphere of the entire meeting was rendered as nearly perfect as it could have been by the isolation and beauty of the Alpine Inn, at Ste. Marguerite, situated in the midst of the Laurentian mountains. Immediately after the symposium the participants went to the International Congress of Ophthal-

mology, held in Montreal and New York—a huge gathering of 3,000 delegates with continuous sets of meetings running in parallel and necessarily strictly limited discussion. Although this provided an excellent opportunity for colleagues all over the world to meet each other, there was no question whatever that the scientific value of one half day at the symposium was greater than that of the whole eight days of the Congress. The C.I.O.M.S. and its two sponsoring bodies, UNESCO and WHO, are indeed to be congratulated on the conception and organization of meetings of this type which probably do more for the advancement of medicine than any other type of conference.

Those taking part were: Ashton (*London*); Bárány (*Uppsala*); Berens (*New York*); Duke-Elder (*London*, Chairman); Elliot (*Toronto*); François (*Ghent*); Friedenwald (*Baltimore*); Goldmann (*Berne*); Grant (*Boston*); Hartmann (*Paris*); Hodgson (*Toronto*, Secretary); Kinsey (*Detroit*); Kronfeld (*Chicago*); Langham (*London*); Leydhecker (*Bonn*); Malbran (*Buenos Aires*); Scheie (*Philadelphia*); Sourdille (*Nantes*); Vail (*Chicago*); Weekers (*Liége*).

SIR STEWART DUKE-ELDER.

NOTES

INTERNATIONAL COUNCIL OF OPHTHALMOLOGY AND INTERNATIONAL FEDERATION OF OPHTHALMOLOGICAL SOCIETIES

Résumé of the minutes of the meetings held at the XVII International Congress of Ophthalmology at Montreal in September, 1954

INTERNATIONAL COUNCIL OF OPHTHALMOLOGY

Apart from current business, the following is a summary of the main decisions taken:

(*1*) *International Standardizations.*—The main business of the meeting concerned the international standardization of visual requirements for transport workers. The reports of the committees dealing with the standardization of optotypes, the colour sense, and the limits of spectacle correction recommended for transport workers were considered and referred to the International Federation for confirmation. A scheme for the codification of the colours of labels of ophthalmic drugs was also agreed. These recommendations will be noted in the Minutes of the Federation.

(*2*) *Ophthalmological Education.*—The Council considered the report presented by Alvaro on behalf of the committee which had been studying the question of ophthalmological education. This was thought to be of such importance that it was decided to submit it to the principal ophthalmic journals in the world for publication.

(*3*) *International Dictionary of Ophthalmic Terms.*—The committee concerned reported on the progress of the "International Dictionary of Ophthalmic Terms"; it is hoped that this dictionary, which contains such terms in six languages (English, French, German, Italian, Latin, and Spanish) will appear in the near future.

(4) *Index Ophthalmologicus.*—The publication of the new *Index Ophthalmologicus* was considered; the Council thanked Dr. A. C. Copper for his excellent work in its preparation. This new Index contains a résumé of the Council's activities, and a list of the names and addresses of ophthalmologists in most countries of the world, as well as particulars of the ophthalmic hospitals, societies for the blind, ophthalmological societies, and ophthalmic journals. The Index can be obtained from Dr. A. C. Copper, 97 Nieuwstad, Zutphen, Holland, for the sum of 2·75 dollars, £1 sterling, or their equivalent.

(5) *Affiliation of new Societies.*—The Council approved requests for affiliation from the ophthalmological societies of Australia, Colombia, India, and Venezuela.

(6) *XVIII International Congress.*—Recommendations were made to the Federation regarding the next International Congress, and the next meeting of the Council was fixed to take place in Paris, on May 7, 1955.

International Federation of Ophthalmological Societies

The main business was as follows:

(1) *New Statutes.*—The new Statutes regulating the activities of the International Council, the International Federation, and International Congresses were studied and, with minor amendments, were provisionally accepted until their final consideration in 1958. According to these statutes, every endeavour is to be made to keep national delegates (and, through them, their societies) acquainted with the work of the International Council.

(2) *Subscriptions.*—The annual subscription for member societies to the Federation was retained without modification, that is, at the rate of one-half Swiss franc per member.

(3) *International Standardizations.*—The recommendations of the Council on international standardization in examining candidates for employment on public transport were considered, as well as the Council's recommendations on the labelling of ophthalmic drugs. The essential recommendations are shown in an appendix (below).

(4) *XVIII International Congress of Ophthalmology.*—It was decided that the next Congress should be held in September, 1958, in Brussels, with Professor Léon Coppez as President; this country was chosen as a compliment to the Belgians in view of the fact that this would be a centenary meeting, the first Congress having been held in Belgium in 1857.

(5) *New International Council.*—The new International Council was elected as follows:

President of the Council (and of the Federation)—Duke-Elder (*Great Britain*).
Vice-President of the Council (and of the Federation)—Berens (*United States*).
Secretary of the Council (and of the Federation)—Hartmann (*France*).
Treasurer of the Council (and of the Federation)—Amsler (*Switzerland*).
President International Association for the Prevention of Blindness—Franceschetti (*Switzerland*).
President International Organization against Trachoma—Bietti (*Italy*).
President Pan-American Association of Ophthalmology—to be appointed in 1956.
Retiring President of the Congress—Samuels (*United States*).
President of the next Congress—Coppez (*Belgium*).

Ordinary members: Alvaro (*Brasil*); Arruga (*Spain*); Charamis (*Greece*); Palomino Dena (*Mexico*); Duggan (*India*); Lyle (*Great Britain*); Marshall (*Canada*); Paufique (*France*); Thiel (*Germany*); Weve (*Holland*).

APPENDIX

(1) TABLES FOR THE TRANSCRIPTION OF THE ACUITY OF VISION FROM THE DECIMAL SYSTEM

For some decimals the distance at the examination has to be altered from 6 to 5 m. or from 20 to 15 ft.

Snellen's 6-metre Tables

1·0	6/6	0·5	6/12
0·8	5/6	0·4	5/12
0·7	6/9	0·3	6/18
0·6	5/9	0·1	6/60

20-foot Tables

1·0	20/20	0·5	20/40
0·8	20/25	0·4	20/50
0·7	20/30	0·3	20/70
0·6	15/25	0·1	20/200

Resolution Angle Tables

1·0	1·0	0·5	2·0
0·9	1·1	0·4	2·5
0·8	1·3	0·3	3·3
0·7	1·4	0·2	5·0
0·6	1·6	0·1	10·0

(2) COLOUR SENSE

The colour sense will be tested by isochromatic tables. At present the Ishihara tables are recommended. Others which may be found to be equally good or better may also be recommended in the future.

(3) TONOMETRY

The Schiötz tonometer is recommended as conforming to the specifications of the Committee on Standardization of Tonometers of the American Academy.

(4) RECOMMENDATIONS FOR THE SPECTACLES ALLOWABLE FOR CANDIDATES FOR EMPLOYMENT IN PUBLIC TRANSPORT

Concave spherical lenses	—7D maximum
Convex spherical lenses	+4D maximum
Cylindrical lenses	±4D maximum

Unshatterable lenses advisable
Periscopic lenses advisable
Tinted lenses advisable only in bright daylight
Stability of the mounting of spectacles important
The provision of a second pair of spectacles as replacements advisable
Contact lenses acceptable if previously tolerated for 3 months

(5) LABELLING OF OPHTHALMIC DRUGS

It is recommended that the labels of ophthalmic medications should be of different colours depending on their nature as follows:

(*a*) *Red.*—Drugs that in certain circumstances can be dangerous, *e.g.*, mydriatics.

(*b*) *Orange.*—Drugs to be used with caution, *e.g.*, miotics, cortisone, priscol, adrenaline, antibiotics, etc.

(*c*) *Green.*—Drugs without danger, *e.g.*, colloidal silver preparations, zinc sulphate, mild antiseptics, antistine, privine, etc.

(*d*) *Red with Green Bands.*—Anaesthetics.

Ophthalmological Society of the United Kingdom

Annual Congress, 1955

The Annual Congress will be held at the Royal Society of Medicine, 1, Wimpole Street, London, W.1., on April 28, 29, and 30, 1955. The presidential address will be delivered by Mr. O. Gayer Morgan on "Some Aspects of Thrombosis of the Retinal Veins and its Treatment". A discussion on "Sarcoidosis" will be opened by Dr. J. G. Scadding, Mr. A. G. Cross, and Mr. R. P. Crick. There will also be short symposia on "Diamox in the Treatment of Glaucoma", "Relaxant Drugs and Anaesthesia in Ophthalmic Surgery", and "The Use of Air in Ophthalmology".

The Bowman Lecture will be delivered by Dr. John H. Dunnington on "Ocular Wound Healing".

Members wishing to read papers, give demonstrations, or show films are asked to communicate with Mr. Ainslie *not later than December 31, 1954.*

The Annual Dinner, to which members may bring guests, will be held on April 28. A Trade Exhibition will be held in the Cowdray Hall (next door to the Royal Society of Medicine). All members who will require hotel accommodation are advised to make their arrangements in good time.

Honorary Secretaries { Arthur Lister (*Council Business*).
Derek Ainslie (*Congress Business*).

Honours

At a Convocation at McGill University, Montreal, on October 6, 1954, the honorary degree of Doctor of Science was conferred on Sir Stewart Duke-Elder.

Mr. B. W. Rycroft has been made an honorary member of the Ophthalmological Society of South Africa.

OBITUARY

LeGrand H. Hardy

Dr. LeGrand H. Hardy died on April 14, 1954, at the age of 59. He was a well-known and well-liked American ophthalmologist, Clinical Professor of Ophthalmology in the College of Physicians and Surgeons at Columbia University, and Director of the Knapp Memorial Physiological Optics Laboratories at the Presbyterian Hospital of New York. His main interest lay in the field of physiological optics in which he was recognized as a world authority.

Walter Löhlein

We have heard with great regret of the recent death of Professor Walter Löhlein of Berlin, one of the foremost German ophthalmologists of his day, and until recently a member of the International Council of Ophthalmology.

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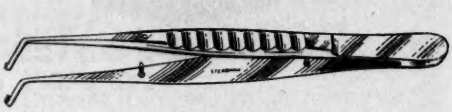

LANG'S FIXATION—WITH STOP

BISHOP-HARMAN FIXATION —RING GRIP

FIXATION—FRENCH MODEL 3/4 TEETH

FIXATION—FRENCH MODEL 2/3 TEETH

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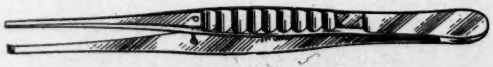
FRANCIS FIXATION 2/3 TEETH



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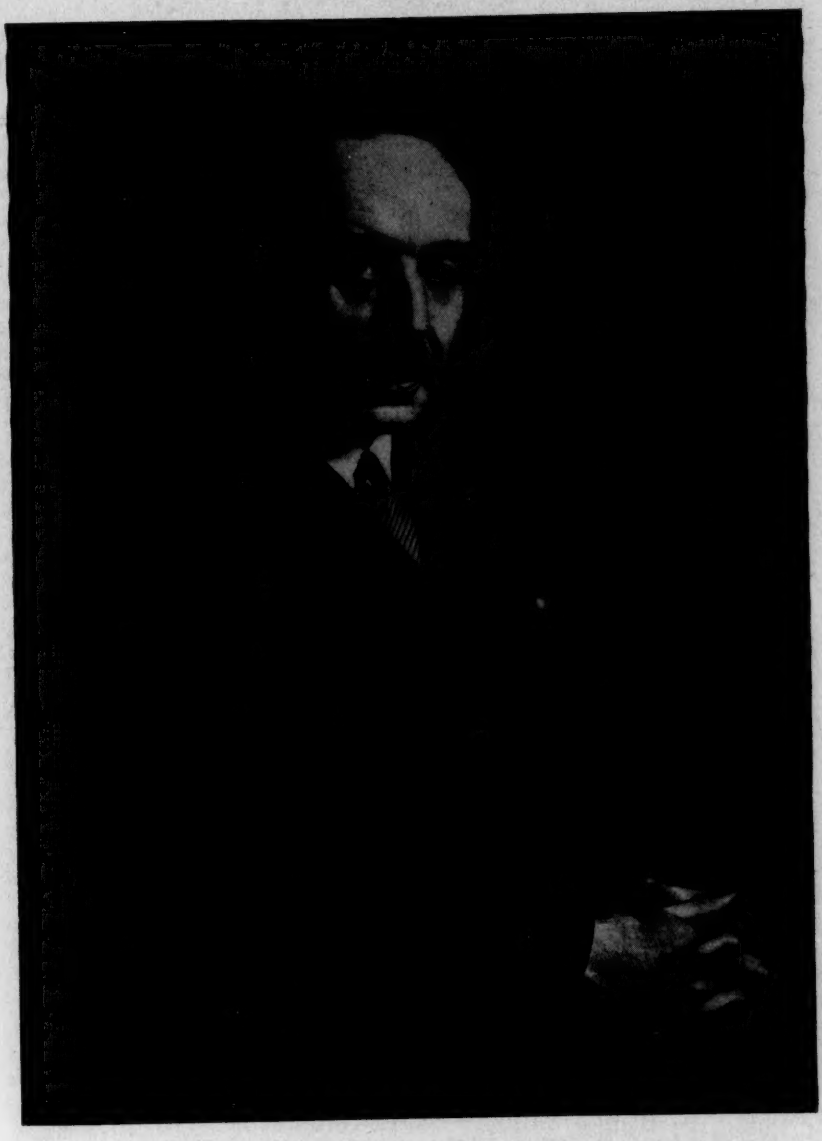

HARRY MOSS TRAQUAIR, 1875—1954

Harry Moss Traquair

Dr. Harry Moss Traquair died on November 14, 1954, at the age of 79. With his death, ophthalmology loses one of her élite. He stood among the few who have, by their lasting contributions to our knowledge, achieved true international eminence.

The younger son of the late R. H. Traquair, F.R.S., Dr. Traquair was born in Edinburgh in 1875 and was educated at Edinburgh Academy, at the University of Halle, and at the University of Edinburgh. During the third or fourth year of his study at Edinburgh University he developed tuberculosis, a misfortune which again affected him during the latter part of his life and was, ultimately, to deprive us of his wisdom and counsel. For this reason he decided to take a post in the Orange Free State, where he remained until he was 21 years of age.

Returning to Edinburgh just before the commencement of the Boer War, he took the degree of M.B., C.M. in 1901, with first-class Honours, and the D.P.H. in the following year. In 1903 he obtained the M.D. and in 1904 he was elected a Fellow of the Royal College of Surgeons of Edinburgh. He was appointed an ophthalmic surgeon to the Royal Infirmary of Edinburgh in 1927 and a Lecturer in Diseases of the Eye, in the University of Edinburgh, in the same year.

He was President of the Royal College of Surgeons of Edinburgh during the period 1939 to 1941, President of the Ophthalmological Society of the United Kingdom during the years 1943 and 1944, and a member of the Council of the Faculty of Ophthalmologists. On his retirement from active practice he was elected the first Honorary Member of the Faculty. Dr. Traquair was also a member of the Senatus Academicus of the University of Edinburgh from 1932 to 1941, and he served on the University Court from 1941 to 1949. He contributed widely to the literature of ophthalmology and was awarded the Middlemore Prize in 1920, the Doyne Memorial Medal in 1922, and the Mackenzie Memorial Medal in 1939.

Having received his first medical training in general practice, Dr. Traquair brought to ophthalmology not only a brilliant academic brain and a natural ability in operative surgery, but a broad clinical outlook which governed his thought throughout his life. Although he was the author of many papers, his most outstanding contribution to medical knowledge was the work which culminated in the publication, in 1927, of " An Introduction to Clinical Perimetry ", of which the 6th edition was published in 1949. This book was, in fact, an amplification of his Middlemore Prize Essay for 1920 on " Perimetry (inclusive of Scotometry), its Methods and its Value to the Ophthalmic Surgeon ". A rich storehouse of painstaking personal observations, carefully selected, this book has become a world classic, and deals with a branch of ophthalmology with which the name of Traquair will always be associated. In his later years Dr. Traquair suffered a long period of painful illness which he endured bravely and philosophically. To the end he retained a characteristic interest in all that was happening in the progress of research work in ophthalmology.

In 1905, while travelling to Ventersburg, Dr. Traquair met Beatrix Nairn who was on her way to New Zealand. They were married in the following year, at Pourerere, and lived at Ventersburg until their return to Edinburgh in 1908. He is survived by his wife and by a son and daughter of their marriage.

INDEX TO VOLUME XXXVIII, 1954

AUTHOR INDEX

PAGE

Achard, Marcel: *See* Nordmann, Jean, Mandel, Paul, and Achard, Marcel
Agarwal, L. P., and Gupta, B. M. L.: Sulphonamides and antibiotic drugs in the treatment of trachoma ... 119
———, and Raizada, I. N.: Congenital membranous cataract, dentigerous cyst, and multiple fibro-lipomata ... 383
———, and Saxena, R. P. : Erythromycin in trachoma ... 690
Anderson, J. Ringland: Latent nystagmus and alternating hyperphoria ... 217
Ashton, Norman: Pathological basis of retrolental fibroplasia ... 385
———, and Cook, Charles: Direct observation of the effect of oxygen on developing vessels. Preliminary report ... 433
———, Ward, Basil, and Serpell, Geoffrey: Effect of oxygen on developing retinal vessels with particular reference to the problem of retrolental fibroplasia ... 397

Bain, W. E. S.: Variations in the episcleral venous pressure in relation to glaucoma ... 129
Ballantyne, J. F.: Siderosis bulbi ... 727
Beattie, C. P.: *See* Beverley, J. K. A., Beattie, C. P., and Fry, B. A.
Beverley, J. K. A., Beattie, C. P., and Fry, B. A.: Experimental toxoplasmosis of the uveal tract ... 489
Björk, Åke: Electromyographic study of conditions involving limited mobility of the eye, chiefly due to neurogenic pareses ... 528
———: Electromyographic studies on the coordination of antagonistic muscles in cases of abducens and facial palsy ... 605
Boase, A. J.: Adenoma of the conjunctiva ... 380
Bruce-Pearson, R. S.: *See* Gurling, K. J., Bruce-Pearson, R. S., and Pond, M. H.

Cagianut, B.: *See* Wunderly, C., and Cagianut, B.
Cameron, A. J.: Experience with the Harrington erisophake in fifty cataract extractions ... 173
Choyce, D. P.: Glass contact lenses. Effects of ventilation ... 100
———: Correspondence ... 575
Cohn, Ludwig: Substitute functions of the blind and the deaf and blind ... 680
Cook, Charles: Uveal lymphosarcoma ... 182
———: *See* Ashton, Norman, and Cook, Charles
Crone, R. A.: Alternating hyperphoria ... 591
Cvetojević, Milica: *See* Pavković-Bugarski, Gjorgje, and Cvetojević, Milica

Dallos, J.: Correspondence ... 319
Dalrymple-Champneys, W.: Correspondence ... 636
Dobree, J. H.: Effect of raised ocular tension on the episcleral vessels. Development of the caput medusae in primary glaucoma ... 500
———, and Fincham, E. F.: Angle of the anterior chamber viewed by transmitted light ... 49
Dollar, Jean M., and Savory, Mary: Exenteration of the orbit and use of alginate mould for applying skin grafts ... 39
Duke-Elder, Sir Stewart: Report of the C.I.O.M.S. Symposium on glaucoma ... 763

Eadie, Stella: Primary tuberculosis of the conjunctiva treated with streptomycin and P.A.S. ... 568
Evans, P. Jameson: A corneal needle ... 630

Fincham, E. F.: *See* Dobree, J. H., and Fincham, E. F.
Foggitt, K. Dean: Ocular disease due to brucellosis ... 273
Foster, John, and Pemberton, E. C.: Hypertropia corrected by changes of the lateral rectus insertion ... 507
François, J., and Neetens, A.: Vascularization of the optic pathway. I. Lamina cribrosa and optic nerve ... 472
Fry, B. A.: *See* Beverley, J. K. A., Beattie, C. P., and Fry, B. A.

PAGE

Greer, C. H.: Choroidal carcinoma metastatic from male breast 312
———: Metastatic carcinoma of the iris 699
Gupta, B. M. L.: *See* Agarwal, L. P., and Gupta, B. M. L.
Gurling, K. J., Bruce-Pearson, R. S., and Pond, M. H.: Sjögren's syndrome treated with ACTH 619
Gustin, J.: *See* Weekers, R., Prijot, E., and Gustin, J.

Hakim, Sohrab A. E.: Argemone oil, sanguinarine, and epidemic-dropsy glaucoma ... 193
Handousa, Ahmed: Localized intra-orbital amyloid disease 510
Heath, Christopher: A case of meningitis apparently secondary to herpetic keratitis and possibly precipitated by cortisone treatment. 58
———: Recovery of sight after rupture of the globe... 567
Hertz, Valdemar: Acute hypotonia 364
Herz, N.: *See* Michaelson, I. C., Herz, N., Lewkowitz, E., and Kertesz, D.
———: *Also* Michaelson, I. C., Herz, N., and Kertesz, D.
Higgit, A. C.: The dark-room test 242
Hobbs, H. E.: Three therapeutic lamellar grafts 61
———, **and Smith, Redmond**: Equatorial cataract after corneo-scleral trephining ... 279
Hodgson, T. H., and MacDonald, R. K.: Slit-lamp studies on the flow of aqueous humour 266
Hoole, T.: *See* Sivasubramaniam, P., and Hoole, T.
Horne, Gordon O.: Topical cortisone in the treatment of syphilitic interstitial keratitis. Preliminary report of twenty cases (26 eyes) 669
Hudson, J. R.: Toxoplasmic choroido-retinitis in the adult 179
Hughes, W. L.: Cataract sutures 345

Ingman, W.: Concussion glaucoma 747

Jacobs, H. Basil: Strength of the orbicularis oculi 560

Kertesz, D.: *See* Michaelson, I. C., Herz, N., Lewkowitz, E., and Kertesz, D.
———: *Also* Michaelson, I. C., Herz, N., and Kertesz, D.

Langham, Maurice, and Wybar, K. C.: Fluorophotometric apparatus for the objective determination of fluorescence in the anterior chamber of the living eye... ... 52
Leigh, A. G.: Opacification in perforating corneal grafts 10
Lenihan, J. M. A.: *See* Snodgrass, Marjory B., Lenihan, J. M. A., and Primrose, David A.
Levinge, M.: Value of abnormal retinal correspondence in binocular vision 332
Lewkowitz, E.: *See* Michaelson, I. C., Herz, N., Lewkowitz, E., and Kertesz, D.
Leydhecker, Wolfgang: Evaluation of the water-drinking test 290
Long, Kathleen M.: Congenital toxoplasmosis 123

MacDonald, R. K.: *See* Hodgson, T. H., and MacDonald, R. K.
Mackie, E. G., and Rubinstein, K.: Iridencleisis in congestive glaucoma 641
Mandel, Paul: *See* Nordmann, Jean, Mandel, Paul, and Achard, Marcel
Mann, Ida: Clinical observations on the prophylaxis of ophthalmia neonatorum... ... 727
Manschot, W. A.: Primary tumours of the optic nerve in Von Recklinghausen's disease ... 285
Mazhar, M.: Hydatid cyst of the orbit... 753
Meyer, E. T.: Familial ectopia lentis and its complications 163
Michaelson, I. C.: Slope of sides of corneal grafts and recipient beds 19
———: Disturbance of the chorio-capillaris and retinal dehiscence 632
———, **Herz, N., Lewkowitz, E., and Kertesz, D.**: Effect of increased oxygen on the development of the retinal vessels. An experimental study 577
———, ———, **and Kertesz, D.**: Effect of increased oxygen concentration on new vessel growth in the adult cornea 588
Moore, J. Gibson: Choroidal detachment following operation for detached retina ... 571
———: Foreign body in the nose simulating acute dacryocystitis 754
Morgan, Alan A.: Stereoscopic vision in relation to photo-interpretation 29

PAGE

Nairac, M. L.: Extra-conjunctival implant 378
———: Correspondence 702
Neetens, A.: *See* François, J., and Neetens, A.
Nordmann, Jean, Mandel, Paul, and Achard, Marcel: Inhibition of sugar metabolism in the lens 673

Osmond, A. H.: New electrode transilluminator 757

Parry, H. B.: Degenerations of the dog retina. IV. Retinopathies associated with dog distemper—complex virus infections. 295
———: ———. V. Generalized progressive atrophy of uncertain aetiology 545
———: ———. VI. Central progressive atrophy with pigment epithelial dystrophy ... 653
Parry, T. G. Wynne: Modification in intra-ocular acrylic lens surgery 616
Pascal, Joseph I.: Method of concordance in the diagnosis of strabismus 22
Pavković-Bugarski, Gjorgje, and Cvetojević, Milica: Terramycin in trachoma 692
Payne, Ian W., and Reed, Howard: Ocular palsies following retrobulbar injection of acetylcholine for retinal arterial occlusion 46
Pemberton, E. C.: *See* Foster, John, and Pemberton, E. C.
Pines, N.: Denig's operation for trachomatous pannus 186
Pond, M. H.: *See* Gurling, K. J., Bruce-Pearson, R. S., and Pond, M. H.
Prijot, E.: *See* Weekers, R., Prijot, E., and Gustin, J.
Primrose, David A.: *See* Snodgrass, Marjory B., Lenihan, J. M. A., and Primrose, David A.
Pugh, Mary: Foveal vision in amblyopia 321

Qadeer, S. A.: Acrylic gonio-subconjunctival plates in glaucoma surgery 353

Raizada, I. N.: *See* Agarwal, L. P., and Raizada, I. N.
Reed, Howard: *See* Payne, Ian W., and Reed, Howard
Reis, J. L.: Histochemical localization of alkaline phosphatase in the retina 35
Ridley, Harold: Further experiences of intra-ocular acrylic lens surgery. With a report of more than one hundred cases 156
Rodger, F. C.: Degenerative changes in the rat visual pathway when thiamin and riboflavin deficiences are combined 144
Roper-Hall, M. J.: Review of 555 cases of intra-ocular foreign body with special reference to prognosis 65
Ross, James A.: A patron saint for British ophthalmologists 634
Rubinstein, Kazimierz: Intra-ocular foreign bodies. Report of 102 cases 369
———: *See* Mackie, E. G., and Rubinstein, Kazimierz
Rycroft, B. W.: The scope of corneal grafting 1

Sarwar, M.: Extraconjunctival approach to the extra-ocular muscles 497
———: Diagnostic contact lens 626
Savory, Mary: *See* Dollar, Jean M., and Savory, Mary
Saxena, R. P.: *See* Agarwal, L. P., and Saxena, R. P.
Sengupta, M.: Neovascularization of the disc in chronic simple glaucoma 685
Serpell, Geoffrey: Polysaccharide granules in association with developing retinal vessels and with retrolental fibroplasia 460
———: *See* Ashton, Norman, Ward, Basil, and Serpell, Geoffrey
Shah, Mahmud Ali: The corneo-scleral track suture. A new technique 239
Sharp, H. S.: Intranasal rhino-dacryo-cystostomy for persistent epiphora in childhood ... 310
Sheehan, B.: Subconjunctival lymphomatous tumour 750
Sivasubramaniam, P.: Keratoplasty clamp 189
———, **and Hoole, T.:** Hernia of the choroid treated by scleral grafting followed by direct suturing of the sclera 126
——— ———: Lamellar keratoplasty followed by cataract extraction in malignant papilloma of the limbus 316
Smith, C. H.: Bacteriology of the healthy conjunctiva 719
Smith, F. W. G.: Lid retractor for cataract extractions 188

PAGE

Smith, Redmond: Gonioscopic studies in congestive glaucoma 136
———: *See* Hobbs, H. E., and Smith, Redmond
Snodgrass, Marjory B., Lenihan, J. M. A., and Primrose, David A.: Radioactive phosphorus as an aid to the diagnosis of malignant melanoma of the eye 553
Stallard, H. B.: Annular peripheral retinal detachment 115
———: The corneo-scleral suture. A technical modification 232

Walker, J. P. Spencer: Congenital absence of inferior rectus and external rectus muscles 631
Walker, W. Martin: Corneal suturing forceps 629
Ward, Basil: Ocular histology in premature infants with reference to retrolental fibroplasia 445
———: *See* Ashton, Norman, Ward, Basil, and Serpell, Geoffrey
Weale, R. A.: Retinal irradiation and aniseikonia 248
Weekers, R., Prijot, E., and Gustin, J.: Recent advances and future prospects in the medical treatment of ocular hypertension 742
Wirth, Alberto, and Zetterström, Birgitta: Effect of area and intensity on the size and shape of the electroretinogram. Exclusion of stray light effects 257
Wunderly, C., and Cagianut, B.: Free amino acids in the human aqueous humour ... 357
Wybar, K. C.: Vascular anatomy of the choroid in relation to selective localization of ocular disease 513
———: *See* Langham, Maurice, and Wybar, K. C.

Young, J. Horton: Magnetic intra-ocular implant. New surgery of the implant—The magnetic artificial eye... 705

Zetterström: *See* Wirth, Alberto, and Zetterström, Birgitta

SUBJECT INDEX

PAGE

Abducens palsy: *See* Palsy
Acetyl choline, retrobulbar injection of 46
—— ——, pharmacology of 48
——, sanguinarine and 198, 200
Acid, amino, in aqueous 357
——, citric 677
——, fluoro-acetic, lens transparency and 677, 678
——, glutaminic, in aqueous 360
——, lactic 674
——, mono-iodacetic, lens transparency and 675, 676
Acrylic lens, intra-ocular, surgical technique 157, 616
—— ——, ——, visual results... ... 159
—— **plates,** gonio-subconjunctival ... 353
—— **resin,** prosthesis of 705
ACTH in Sjögren's syndrome 619
—— —— —— ——, arthritis and ... 623
—— —— —— ——, eyes and ... 622
—— —— —— ——, salivary glands and 623
—— —— —— ——, urinary ketosteroids and 620, 623
Action potentials in ocular muscles 528, 536, 543, 608, 609
Adenoma: *See* Tumour
Adenosine triphosphate: *See* ATP
Adrenaline, ocular tension and 197, 201, 245, 743
——, sanguinarine and 197, 201, 211
Alanine in aqueous 360
Alginate mould, skin grafting and ... 39
—— ——, handle for 42
Alkaline phosphatase, retinal 35
Allergy, toxoplasmosis and ... 489, 495
Alloxan, corneal vascularization and ... 433
Alopecia, dietary deficiency and 147, 150
Amblyopia 321
——, hyperphoria and 592
——, retinal correspondence in 329, 331, 339
Amino acids in aqueous 357
Amyloidosis, intra-orbital 510
Anatomy, vascular, of choroid ... 513 et seq.
——, ——, —— optic pathway ... 472
Angioblastic activity, retinal 386, 407, 446
Aniseikonia 248
Antibiotic: *See* under individual drugs
—— in ophthalmia neonatorum ... 739
——, resistance to, of conjunctival pathogens ... 719, 723, 732
Antigen-antibody reaction, keratoplasty and 6
Aphakia, foreign body and ... 88, 93

Appliances:
Corneal needle 630
Corneal suturing forceps 629

PAGE

Appliances (*contd.*):
Diagnostic contact lenses 626
Fluorophotometric apparatus ... 52
Handle for alginate mould 42
Instrument for measuring orbicularis oculi 560
Keratoplasty clamp 189
Lid retractor for cataract extractions 188
Manipulative key for insertion of magnetic implant 706
Ox-eye perfusion apparatus 205
Transilluminator, for viewing angle of anterior chamber 49
——, new electrode 757

Aqueous flow 52, 266, 742
—— ——, adrenaline and ... 743, 744
—— ——, fluorescein studies ... 52, 266
—— ——, iridencleisis and ... 641, 742
—— ——, pilocarpine and 268
—— ——, radioactive studies of ... 54
—— ——, slit-lamp studies of 266
——, free amino acids in 357
—— veins 270, 745
Arachnodactyly 163, 169
Argemone ... ... 193 et seq.
——, alkaloids of: *See* Sanguinarine
——, chemistry of 195
Arterial circle of iris 516
—— —— of Zinn-Haller ... 473, 478
Artery, anterior ciliary ... 500, 502, 526
——, central optic nerve 482
——, —— retinal 472 et seq., 648, 688
——, hyaloid 480, 481
——, ophthalmic 474
——, retinal, occlusion of 46
——, short posterior ciliary ... 472, 513
Artificial eye 705
—— **tears** 622, 625
Ascites, sanguinarine and 201
ATP, pathogenesis of cataract and 673 et seq.
Aureomycin, conjunctivitis and 720, 732
——, trachoma and 119
Avitaminosis 144, 510
Ayurvedic medicine 195

Bacilli, coliform, in conjunctiva 725, 727
Bacitracin in conjunctival infections ... 725
Bacteria, conjunctival 19, 719
BAL, sanguinarine and ... 201, 211
Barkan's goniotomy 641
Bell's phenomenon ... 227, 601, 610
" Benzene ring " muscle schema ... 23
Bielschowsky's phenomenon 227, 592, 601
Binocular vision, abnormal retinal correspondence in 332

PAGE

Birth difficulties, ocular defects and 221, 229
Blindness, substitute functions in ... 680
Blood, choroidal supply of, ocular disease and ... ... 513 et seq.
—— supply to optic pathway 472
—— —— —— —— ——, comparative anatomy of 481
—— —— —— —— ——, embryology 479
—— —— —— —— ——, experimental studies of 482
Blood-aqueous barrier 54

Book Reviews:

ADLER, F. H.: Physiology of the Eye (2nd ed. 1953) 250

AMSLER, M., BRÜCKNER, R., FRANCESCHETTI, A., GOLDMANN, H., and STREIFF, E. B.: Lehrbuch der Augenheilkunde (2nd ed. 1954) 250

BERENS, CONRAD, and SHEPPARD, L. BENJAMIN: Abstracts on Military and Aviation Ophthalmology and Visual Sciences (1953) 441

BING, R., and BRÜCKNER, R.: The Brain and the Eye (1954) ... 442

BRITISH ORTHOPTIC JOURNAL ... 575

CALAMANDREI, G., FERRATA, L., and MONTANARI, L.: The Corticotropic Hormone and Cortisone in Ophthalmology *(1953)* ... *250*

CSAPODY, ISTVAN: Augenhöhlenplastik (1953) 574

DUKE-ELDER, SIR STEWART: Parsons's "Diseases of the Eye" (12th ed. 1954) 190

—— ——: Text-book of Ophthalmology. Vol. VI. Injuries (1954) 573

—— ——: *The Practice of Refraction* (6th ed. 1954) 703

GERMER, W. D.: Virus Diseases in Man (1954) 320

GUILLAUMAT, L., SCHIFF-WERTHEIMER, S., OFFRET, G., and DUBOIS-POULSEN, A.: Ophthalmologie (1953) 250

HAESSLER, F. HERBERT: Ophthalmologic Diagnosis (1953) ... 251

INDEX OPHTHALMOLOGICUS ... 576, 766

KÖHLER, A., and ZIMMER, E. A.: The Normal and Pathological Radiographic Appearances of Bone *(9th ed. 1953)* 128

JAENSCH, P. A.: Test Types (Sehproben nach A. ROTH) (5th ed. 1953) *191*

LEVITT, T.: The Thyroid (1954) ... 251

PAGE

Book Reviews (*contd.*):

LYLE, T. KEITH, and CROSS, A. G. (editors): May and Worth's "Manual of Diseases of the Eye" (11th ed. 1954) 703

—— ——, and WALKER, M.: Lyle and Jackson's "Practical Orthoptics in the Treatment of Squint" (4th ed. 1953) ... 191

MICHAELSON, I. C.: Retinal Circulation in Man and Animals (1954) 441

PAUFIQUE, L., BONNET, P., and BRUN, J.: Tuberculoses oculaires et tuberculoses paraganglionaires (1953) 703

SAFAR, K.: Electro-Surgery of the Eye (1953) 252

VAIL, DERRICK, and LINDSAY, JOHN R.: The Year Book of Eye, Ear, Nose, and Throat for 1953–4. (1954) *512*

VERREY, F.: The Clinical Pathology of the Aqueous Humour (1954) 512

WALLS, G. L.: The Lateral Geniculate Nucleus and Visual Histophysiology (1953) 190

WOLFF, EUGENE: Anatomy of the Eye and Orbit (4th ed. 1954) 574

ZUCKERMAN, J.: Perimetry (1954) ... *702*

***Books Reviewed* in Ophthalmic Literature:**

NORDMANN, J.: Biologie du cristallin *(1954)* *320*

Bowman's membrane, contact lenses and 100
Braille, Louis *680*
Brucellosis, diagnosis of ... 275, 636
——, ocular manifestations of 273, 277, 636
——, pathology of 275, 636

Capsule, adhesions of, post-trephine ... 282
Caput medusae in glaucoma 500
Carbohydrate cycle in pathogenesis of cataract ... ... 673 et seq.
Carbon dioxide, retrolental fibroplasia and 414
Carcinoma, secondary, in choroid ... 312
——, ——, —— iris *699*
Cataract, acrylic lens and 156
——, capsular adhesion and 282
——, congenital membranous 383
—— in dog 552
——, *equatorial* 279
—— extraction in malignant papilloma 316
—— —— with Harrington's erisophake 173
——, foreign body and ... *87, 91, 92, 93*
——, pathogenesis of 673

PAGE

Cataract, post-trephine... 279
—— sutures 345
——, wound closure in... 347
Catgut, cataract sutures of 346
Chamber, anterior, angle of 49, 136, 244, 353
——, ——, depth of 136
——, ——, fluorescence determination in 52
Chavasse slides in amblyopia 328
Chelerythrine 211
Chemotherapy: *See* Antibiotic and Sulphacetamide
—— in toxoplasmosis 490
" Chicalotl " herb 194
Chloramphenicol in brucellosis 277
—— —— conjunctivitis ... 720, 732
—— —— trachoma 119
Cholinesterase inhibitors in glaucoma 742
Chorio-capillaris, retinal dehiscence and 632
——, vascular anatomy of 526
Choroid, atrophy of 665
——, *blood supply of* 473, 484, 513 et seq.
——, carcinoma of 312
——, damage by foreign body of ... 94
——, detachment of ... 283, 364, 571
——, hernia of 126
——, secondary carcinoma of 312
——, " sectors " of 513, 515
——, vascular anatomy of 513
——, " zones " of 514, 521
Choroido-retinitis, toxoplasmic... ... 179
Chromatography, aqueous amino acids and 357, 362
Chromicized gut, cataract sutures of 346, 347
Ciliary body, damage by foreign body 90, 92
—— venous plexus 134
Cinchona alkaloids 199
Coaptation: *See* Retina
Concordance, diagnosis of strabismus and 22

Congresses:
C.I.O.M.S. Symposium on Glaucoma 763
International Congress of Ophthalmology 765
International Congress of Oto-Neuro-Ophthalmology 128
Irish Ophthalmological Society ... *191*
Ophthalmological Society of Egypt 128
Ophthalmological Society of New Zealand 444
Ophthalmological Society of the United Kingdom ... 442, 768
Oxford Ophthalmological Congress *252, 576*
Pan-American Congress of Ophthalmology 192

Conjunctiva, adenoma of 380
——, *bacteriology of healthy* 719
——, contamination by unsterile drops 725
——, Gram-negative bacilli and 725, 727
—— in trachoma *690, 696*

PAGE

Conjunctiva, lymphomatous tumour under 750
——, neonatal infection of 727
——, tuberculosis of 568
Conjunctivitis, antibiotics and ... 724, 727
Contact lenses 497
—— ——, diagnostic 626
—— ——, fitting 104, 107
—— ——, glass, ventilated ... 100, 319
Convergence, ocular 342
Cornea, capillaries of 51
——, grafting of: *See* Keratoplasty
——, oxygen and 588
——, vascularization of 433, 488 et seq., 588
Corneal Grafting Act, 1952 5
—— trephining 279, 644
Corneo-scleral suture, technique 232, 239, 629

Correspondence:
Extra-conjunctival implants... 575, 702
Ocular disease due to brucellosis ... 636
Ventilated glass contact lenses ... 319

Correspondence, retinal 220
——, ——, *abnormal* 332
——, ——, ——, treatment 343
——, ——, binocular vision and ... 332
——, ——, in amblyopia 329, 331, 339
Cortex, amblyopia and... 321, 329, 331
Cortisone in herpetic keratitis 58
—— —— *interstitial keratitis* 669
—— —— occlusion of pupil 160
—— —— Sjögren's syndrome ... 625
—— —— sympathetic ophthalmia 649, 651
—— —— *toxoplasmosis* 492
—— *meningitis precipitated by* ... 58

Courses:
Birmingham and Midland Eye Hospital 192, 252
Midland Ophthalmological Society 64, 704
University of Iowa 252

Crédé: *See* Silver nitrate
Culture, pre-operative, of conjunctiva... 725
***Cutler's* implant**... ... ... *378*
Cyclodialysis 353, 572, 648, 743
Cyclophoria 507
Cyst, dentigerous *383*
——, hydatid, of the orbit 753
——, *retinal* 571

Dacryocystitis, foreign body simulating 754
Deafness, substitute functions in ... 680
Demyelinization, dietary deficiency and 147, 148, 150
Denig's operation 186
D.F.P. in glaucoma 742, 745
Diabetes, glaucoma and ... *160, 648*
Diaminodiphenylsulphone, toxoplasmosis and... 490
" Diamox " in glaucoma ... 743, 745
Diathermy, foreign body removal and... 96
——, *retinal detachment and* 118

PAGE

Diathermy, retrociliary 743, 745
——, technique of 757
Diazo-dye method for alkaline phosphatase 36
Dibenamine in glaucoma 743
Dihydrosanguinarine: *See* Sanguinarine
Diplopia, acrylic lens and 160
——, physiological 342
——, tests of 23
Dog retina, degenerations of ... 295, 545
Dropsy, epidemic, in India ... 195, 685
——, ——, biochemistry of ... 200, 201
——, ——, histopathology of 203
——, ——, glaucoma and 193, 201, 203, 213, 685
Drugs, ophthalmic, international standardization of labels 767

Ectopia lentis 163
—— ——, genealogical table 165
—— ——, treatment of 171
Ehrlich, intravenous fluorescein and ... 52
Electromyography 528, 605
Electroretinogram ... ... 257 et seq.
—— in dog retinal degeneration 653, 656, 659, 661
Elliott's trephine 644, 742
Embryology 457, 479
Endothelioma 289
Enolase 679
Enzyme studies 468, 678
Ephedrine, sanguinarine and 211
Epiphora, persistent 310
Erisophake, Harrington's 173
Erythromycin in trachoma 690
Eserine, glaucoma and 132, 141, 501, 742, 745
Esotropia 592, 603, 631
Exophthalmos, pulsating 285
Exotropia 592
External rectus: *See* Lateral rectus
Eye, magnetic artificial 705
Eyeball: *See* Globe

Fibrillation of ocular muscles 537
Fibrolipomata 383
Filtration angle: *See* Chamber, anterior, angle of
Fixation in amblyopia 321, 326
Fluorescein, aqueous flow and ... 52, 266
Fluorophotometer 52
Forceps, corneal suturing 629
Foreign body, age incidence ... 66, 370
—— ——, cataract and 87, 91, 92, 93
—— ——, cause of injury 67, 372, 731
—— ——, chorio-retinal scarring and 94
—— ——, complications 86, 90, 93, 374
—— ——, glaucoma and 94
—— ——, intra-ocular 65, 369, 758, 727
—— ——, iron, staining from 727
—— ——, magnetic response 67
—— ——, prognosis ... 65 et seq., 71, 727

PAGE

Foreign body, retained 80, 730
—— ——, retinal detachment and 86, 91, 92, 94
—— —— simulating dacryocystitis ... 754
—— ——, steel 732
—— ——, surgical route ... 82, 370, 373
—— ——, uveal damage and ... 90, 92
—— ——, visual results 72, 78, 83, 96
Fovea, vision in amblyopia 321
Fundus examination with contact lens 627
——, tapetal, degeneration in dog 656, 659
Fusion, alternating hyperphoria and 220, 229

Geniculate body, lateral, amplyopia and 321
Gland, lacrimal 619
——, parotid 621
——, salivary 623
Glaucoma, absolute ... 133, 500, 502, 647
——, acrylic lens and 160
——, aqueous flow in ... 268, 641, 742
——, argemone and ... 193 et seq., 213
——, caput medusae in 500
——, cataract in 279
——, closed-angle, and hypertension ... 745
——, concussion 747
——, congestive ... 131, 133, 136, 243, 501
——, ——, surgery ... 641, 643, 742
——, ——, ——, rationale 642
——, ——, visual acuity in ... 645, 646
——, dark-room test 242
——, diabetes and 648
——, ectopia lentis and 164, 169, 171, 172
——, epidemic-dropsy and 193, 204, 685
——, episcleral vessels and 500
——, gonioscopic studies of 136
——, gonio-subconjunctival acrylic plates in 353
——, iridencleisis in 641, 742
——, malignant 282, 283
——, miotics and 132, 245, 268, 501, 742
——, mydriatic test 242
——, primary 500
——, sanguinarine and ... ... 205 et seq.
——, simple 131, 243, 501, 742
——, ——, neovascularization of disc in 685
——, ——, venous shunt and 688
——, surgery in 642, 747
——, symposium on 763
——, thrombotic ... 133, 502, 647
——, traumatic 94, 747
——, unresolved 707
——, uveal lymphosarcoma and ... 182
——, venous pressure and 129
——, water-drinking test 290
Glioma of chiasma 288, 289
Globe, dislocation of 539, 540
——, excision of 66, 92
—— in retrolental fibroplasia 386
——, mobility of, E.M.G. studies 528 et seq.
——, rupture of, vision after 567
Glutamine in aqueous 360
Glyceraldehyde, lens transparency and 674
Glycine 358

PAGE

Glycogen, retinal 460, 470
Gomori's method for alkaline phosphatase 35
Gonin oration 444
Gonioscopy 136, 626
Goniotomy 641
Gonococcus, conjunctivitis and ... 727
Graft, corneal, scope of 1
——, ——, preservation of 5
——: *See also* Keratoplasty
——, scleral 126
——, skin, alginate mould and ... 39
Gram-negative bacilli, conjunctiva and 725, 727

Haemorrhage, intra-ocular ... 91, 92, 648
——, retinal 446, 688
Haloes 138, 204
Harrington's erisophake 173
Heredity and retinal atrophy in dog ... 547
—— and ectopia lentis 163
Hering's law 601
Hexokinase 678
Histidine in aqueous 360
Histochemistry of localization of alkaline phosphatase 35
—— of polysaccharide in retina 460 et seq.
Histology, ocular 445
Holth iridencleisis 641

Honours:
DUKE-ELDER, SIR STEWART ... 64, 768
LAW, FRANK 128
PARSONS, SIR JOHN HERBERT ... 320
PHILPS, SEYMOUR 252
RYCROFT, B. W. 768
SWAN, C. S. 444
THOMAS, J. W. TUDOR 576

Humour: *See* Aqueous and Vitreous
Hyaloid system ... 386, 434, 460, 480, 481
Hydatid cyst, orbital 753
Hydrolysis 674
Hyperoxia, corneal vascularization and 433
——, retrolental fibroplasia and 400, 403, 405, 414, 430, 577
Hyperphoria, alternating 217, 225, 591 et seq.
——, ——, causes 221, 227
——, ——, treatment 230
——, ——, fusion in 220, 229
——, double 226
Hypertropia 591, 596, 631
——, alternating 226
——, surgical correction of 507
Hyphaema 93, 648
Hypotension 647
Hypotonia, acute 364
Hypoxia, retrolental fibroplasia and 414, 418, 431, 577

PAGE

Image, retinal, factors influencing ... 248
Implant, Cutler's 378
——, extra-conjunctival 378, 575, 702
——, intra-ocular magnetic 705
——, —— ——, surgical technique 707 et seq.
Inclusion bodies in trachoma 119
Indian ink studies of ocular blood supply 519, 520, 577
Inferior rectus, congenital absence of ... 631
—— **oblique**, alternating hyperphoria and 227, 228
Inhibition, cortical, in amblyopia 321, 329, 331
Insulin, sanguinarine and 200
Internal rectus: *See* Medial rectus
Iridectomy for haemorrhage ... 92, 93
—— in glaucoma 641
—— *vs.* iridencleisis in glaucoma ... 641
Iridencleisis 641, 742
——, sympathetic ophthalmia and ... 649
Iridodonesis 169
Iridotasis 650
Iris bombé 137, 160
——, carcinoma secondary of 699
—— inclusions in anterior chamber ... 51
—— in glaucoma 137, 648
Iritis, acrylic lens and 160
——, toxoplasmic 489
Iron, corrosion, diffusion, and precipitation in eye from foreign body 727
Isotopes, radioactive 553
——: *See also* P^{32}

Keratic precipitates 649
Keratitis, herpetic 58
——, interstitial 11, 13
—— ——, cortisone in 669
——, 'Primrose' 4
——, traumatic burn 4
Kerato-conjunctivitis sicca 619
Keratoplasty, administrative problems 5
——, anterior synechiae after 14
——, biological problems 6
——, choice of case 16
——, dislocation of graft 13
——, history of 1
——, infection complicating 14
——, lamellar 61, 316
——, ——, for malignant papilloma ... 316
——, loss of vitreous after 14
——, oedema after 6, 14
——, opacification after 10
——, operative technique 3
——, post-operative treatment ... 17
——, preparation of recipient bed ... 20
——, slope of graft sides in 19
——, technique of cutting graft 3, 16, 19
Ketosteroids, in Sjögren's syndrome 620, 623
Klein, J. W. 680

PAGE

Lacrimation, ACTH and 619
Lagrange's sclerecto-iridectomy 641, 742
Lamina cribrosa, vascularization of ... 472
Lateral rectus, congenital absence of ... 631
—— ——, hypertropia and 507
—— —— palsy 535, 536, 606
—— ——, surgical approach 498
Leber, vascular studies of 473, 513, 521
Lens, acrylic: *See* Acrylic lens
——, capsular adhesion 282
——, contact: *See* Contact lenses
——, foreign body and... 90
——, glaucoma and 136
——, subluxation of ... 163, 283, 649
——, sugar metabolism in 673
Leucine, ... 358
Levator palpebrae superioris, E.M.G. studies of 609
Light balance adaptability in amblyopia 327
——, transmitted, angle of anterior chamber by 49
Lorm, H., ... 680
Limbus, papilloma of 316
Lycine, ... 358
Lymphoma: *See* Tumour
Lymphosarcoma, uveal 182
——: *See also* Tumour

Magnet in prosthesis 705
——, response of foreign body to ... 67
Marchesani's syndrome... 168
Marchi bodies 147, 148
Marfan's syndrome 163, 168
Medial rectus, E.M.G. studies of 532, 606
—— ——, hypertropia and 507
—— ——, surgical approach 499
Melanoma, malignant, of eye 553
Membrane, internal limiting, retrolental fibroplasia and 386, 447, 460
Meningitis in herpetic keratitis and cortisone 58
Mercury dichloride in ophthalmia neonatorum 728
Mesenchyme, retrolental fibroplasia and ... 393, 461, 464, 465
Methionine 358
Milk, brucellosis from 274
Miotics, glaucoma and 132, 245, 268, 501, 742
Motor neuron, peripheral, lesions of 528 et seq., 543
Muscle, antagonistic co-ordination of 605, 614
——, extra-ocular, E.M.G. studies of 528, 605
——, ——, extra-conjunctival approach 497
——, schema 23

Needle, corneal 630
Neoprene studies of ocular blood supply 482, 513, 516, 523
Neurofibromatosis 285

PAGE

Nylon, cataract sutures of 346
Nystagmus, congenital 225
—— in hyperphoria 592, 598
——, latent 217
——, opticokinetic 608
——, paretic 541
——, rotatory 228, 592

Obituary:

HARDY, LEGRAND H.... 768
KIRBY, DANIEL B. 192
LETCHWORTH, THOMAS WILFRED ... 640
LÖHLEIN, WALTER 768
MEIGHAN, STUART SPENCE 384
SCOULAR, LESLIE GEMMILL 444
SEMADENI, BERNADO 192
SIMPSON, WILLIAM HENRY 704
TRAQUAIR, HARRY MOSS 769
WOLFF, EUGENE 253

Occlusion, effect of 593
Oedema complicating keratoplasty ... 6, 14
——, corneal, sanguinarine and ... 204
——, hypoproteinaemic, sanguinarine and 201, 203
——, retinal, prematurity and 446
——, ——, retrolental fibroplasia and 387 et seq.
——, skin, sanguinarine and 201
Opacification of corneal grafts... ... 10
Ophthalmia neonatorum, prophylaxis ... 727
—— ——, skin infection and ... 730, 733
——, sympathetic 649
Ophthalmoplegia after retrobulbar acetylcholine 46
——, E.M.G. studies of 513
Optic disc, cupping of 138, 204
—— ——, neovascularization in glaucoma 685
—— **nerve,** primary tumours of ... 285
—— ——, vascularization of 472
—— ——, —— ——, comparative anatomy 481
—— ——, —— ——, embryology ... 479
—— ——, —— ——, experimental studies 482
Ora serrata, retrolental fibroplasia and 386 et seq., 398, 456
Orbicularis oculi, facial palsy and ... 609
—— ——, strength of 560
Orbit, amyloid disease in 510
——, exenteration of 39, 40
——, hydatid cyst of 753
——, lymphomatous tumour in ... 750
——, skin grafting of 39
Oxygen, chick embryo and 439
——, corneal vascularization and 433, 588 et seq.

PAGE

Oxygen, retina of kitten and ... 434, 466
——, —— —— mouse and 577
——, retrolental fibroplasia and 394, 397 et seq., 423, 577
——, toxic effects of ... ...
——, vaso-constrictor effect of 420, 436, 437
——, vaso-obliterative effect of 400 et seq., 433, 437

P^{32}, aqueous flow and 54
——, malignant melanoma and ... 553
Palsy, abducens 533, 535, 537, 542, 605 et seq.
——, facial 605
——, lateral rectus 606
——, oculomotor ...28, 46, 529, 542, 609
——: *See* Ophthalmoplegia
Pannus, trachomatous 120, 121, 691, 693
——, ——, Denig's operation and ... 186
Papilla, vascularization of 484
Papaver alkaloids ... 211, 213, 214
Papilloma, malignant, of limbus ... 316
Paresis of ocular muscles, E.M.G. studies ... ... 528 et seq.
Parotid gland, Sjögren's syndrome and 621
PAS method, for polysaccharide 460, 461
—— in ocular tuberculosis 568
Pascal muscle schema 23
Penicillin, conjunctivitis and 719, 725, 732, 739
——, staphylococcus and ... 724, 728
Perforation, traumatic, of globe ... 707
Phakoerisis 174
Phenylalanine 358
Phloridzine, lens transparency and 675, 677
Phosphorus, radioactive: *See* P^{32}
Photo-interpretation, stereoscopic vision and 29
Phthisis bulbi 707
Pigment epithelial dystrophy, in dog ... 653
Pigmentation, in neurofibromatosis ... 287
——, iron, from foreign body 727
Pilocarpine in glaucoma 132, 134, 141, 268, 502, 742, 745
—— in saliva 620
Poliosis 649
Polymyxin in conjunctival infections ... 725
Polysaccharide granules, retrolental fibroplasia and 460
Prematurity, ocular histology of 445, 465
——, retrolental fibroplasia and 385, 445 et seq., 460
Pressure, episcleral venous 129
——, intra-ocular: *See* Tension, ocular
Priscol, retrolental fibroplasia and ... 414

Prizes:

Chibret Gold Medal 192
Percival J. Hay Memorial Prize ... 444
Treacher Collins Prize 444

Proptosis due to amyloid tumour ... 510
Prosthesis, magnetically activated ... 705

PAGE

Prosthesis, skin attached 44
——, spectacle-attached 43
Proteins, plasma, sanguinarine and 201, 202
Ps. pyocyaneus conjunctivitis 725
Pulfrich effect 248
Pupil, occlusion of 160
Pyruvate oxidase, sanguinarine and ... 200

Quinidine 199

Radioactivity: *See* Isotopes; P^{32}
Radiotherapy of single lymphoma ... 752
Retina, alkaline phosphatase in ... 35
——, arterial occlusion of 46
——, atrophy of, in dog 545 et seq., 653 et seq.
——, blood supply of 474
——, coaptation... ... ... 445, 455
——, degeneration of, in dog 295, 545, 653
——, —— ——, sanguinarine and ... 204
——, dehiscence of 632
——, detachment of, acute hypotonia and 364
——, —— ——, annular peripheral ... 115
——, —— ——, chorio-capillaris and 632
——, —— —— foreign body and 86, 91, 92, 94 et seq.
——, —— ——, in dog 551
——, —— ——, localization of ... 757
——, —— ——, in retrolental fibroplasia ... ... 387 et seq., 445
——, —— ——, post-operative chorioidal detachment 571
——, dog distemper and 295
——, haemorrhage in 446, 688
——, irradiation of, aniseikonia and ... 248
——, oral, folds in 455
——, retrolental fibroplasia and 386 et seq., 445
——, vascular endothelium of... ... 37
——, vascularization in 386 et seq., 407, 434, 445, 448, 451
——, —— ——, effect of oxygen 401 et seq., 577
——, —— ——, in simple glaucoma ... 685
——, —— ——, polysaccharide granules and 460
——, vaso-formative tissue in 386 et seq., 407, 445, 448
Retinitis pigmentosa 521, 664
—— proliferans 394
Retinopathy, central angiospastic ... 665
——, dog distemper and ... 295 et seq.
——, hypertensive 648
Retrobulbar injection of acetyl choline 46
Retrolental fibroplasia, carbon dioxide and 414
—— ——, mesenchyme in 393
—— ——, oxygen and 394, 397 et seq., 423, 577, 585

PAGE

Retrolental fibroplasia, pathological basis of ... ... 385 et seq.
—— ——, polysaccharide granules and 460 et seq.
—— ——, prematurity and 385, 445 et seq., 460
—— ——, priscol and 414
—— ——, retinal changes ... 386 et seq.
—— ——, stages 395
—— ——, tromexan and 415
—— ——, vaso-obliterative phase 400, 402, 405, 414, 420
—— ——, vaso-proliferative phase 392, 407, 416, 422
Rheumatoid arthritis in Sjögren's syndrome 620, 623
Rhino-dacryo-cystostomy, intra-nasal ... 310
Riboflavin, rat visual pathway and ... 144

Saint Medana 634
Saint Triduana 634
Sanguinarine ... ... 193 et seq.
—— antogonism by BAL 201, 202, 211, 213
——, biochemistry of 200
——, glaucoma and, experimental studies of ... ... 205 et seq.
——, pharmacology of 197
——, plasma protein and ... 201, 202
——, toxicology of 196
Schirmer's test 619
Schiötz tonometer, international standardization of... 767
Schlemm's canal 51, 137
Schwalbe's line 51, 137
Sclera, blood supply of... ... 473, 484
——, grafting of 126
Scleromalacia perforans... 127
Sens de l'obstacle 683
Serine 358
Serology in toxoplasmosis 489
Sherrington and ocular muscles ... 612
Siderosis 80, 92
—— **bulbi** 727
Silk, cataract sutures of 345
Silver nitrate in ophthalmia neonatorum 727
Sjögren's syndrome 619
Slit lamp... ... ... 266, 619, 627
Snellen type in amblyopia 328

Societies:
American Ophthalmological Society 576
Council for International Organizations of Medical Sciences ... 763
Faculty of Ophthalmologists ... 576
——, Study Tours 1954 637
International Congress of Oto-Neuro-Ophthalmologists 128
—— Council of Ophthalmology ... 765

PAGE

Societies (*contd.*):
International Federation of Ophthalmological Societies 765
Irish Ophthalmological Society ... 191
League against Trachoma 192
Midland Ophthalmological Society 64, 704
Ophthalmological Society of Egypt... 128
Ophthalmological Society of New Zealand 444
Ophthalmological Society of the United Kingdom ... 442, 768
Oxford Ophthalmological Congress 252, 576
Pan-American Congress of Ophthalmology... 192
University of Iowa, Dept. of Ophthalmology... 252

Sodium fluoride, lens transparency and 673, 675, 676
—— **malonate,** lens transparency and 676, 677
——, radioactive, aqueous flow and ... 54
Spherophakia 168
Squint: *See* Strabismus
Staphylococcus, resistance of, to antibiotics 724, 725, 728
"Stent" compared with alginate mould 44
Stereopsis 342
Stereoscopic vision, photo-interpretation and 29
—— ——, refractive errors and ... 32
—— ——, suppression and 32
Stock's syndrome 665
Strabismus, diagnosis of, concordance in 22
—— in hyperphoria 217, 592
—— in latent nystagmus 220
——, retinal correspondence and ... 332
—— surso-abductorius 593, 598
—— surso-adductorius 593, 596
——: *See also* Palsy
Streptomycin in conjunctivitis 725, 732
—— in ocular tuberculosis 568
Sugar metabolism in lens 673
Sulphonamides, conjunctivitis and 720, 728
——, trachoma and 119, 692
Superior oblique, alternating hyperphoria and 227, 228
—— rectus, paresis of 533, 611
Suppression in amblyopia ... 326, 334
——, stereoscopic vision and 32
Surgery, acrylic lens 156, 616
—— of cataract extraction 173
—— of choroidal hernia 126
—— of extra-ocular muscles ... 498, 507
—— of foreign body 65, 369
—— —— —— ——, approach 82, 88, 89, 94, 370, 373

PAGE

Surgery of foreign body, complications 86, 90, 93, 374
—— —— —— ——, technique ... 86
—— of glaucoma ... 353, 641, 742, 747
—— —— ——, complications 647, 648
—— of hypertropia 507
—— of magnetic implant 707
—— of orbital exenteration 40
—— of persistent epiphora 310
Sursumduction: *See* Hyperphoria
Suture, cataract 345
——, corneo-scleral 232, 239
—— in muscle surgery 498
"Svarnakshiri" herb 194
Sympathetic ophthalmia... 94
—— ——, iridencleisis and 649
Synechiae, anterior, complicating keratoplasty 14
——, ——, foreign body and ... 93, 94
——, ——, glaucoma and ... 131, 132
——, ——, viewed by transmitted light 51
Synoptophore 334, 338, 339, 594
Syphilis, interstitial keratitis in, cortisone and 669

Tension, ocular, adrenaline and ... 743
——, ——, dark-room test and... ... 242
——, ——, ectopia lentis and 164, 169, 171, 172
——, ——, episcleral venous pressure and 129, 500
——, ——, eserine and 132, 141, 501, 742, 745
——, ——, mechanism of rise in 136, 137
——, ——, medical treatment of ... 742
——, ——, miotics and 131, 132, 501
——, ——, mydriatic test and... ... 242
——, ——, phasic variations in 130, 500
——, ——, pilocarpine and 132, 134, 141, 502, 742, 745
——, ——, sanguinarine and 193, 204 et seq.
——, ——, water-drinking test and ... 290
——, ——: *See also* Hypotonia; Glaucoma
Terramycin in conjunctivitis 732
—— —— trachoma 119, 692
Test, after-image 334, 340
——, binocular, in amblyopia 326
——, brucellin 275
——, dark-room 243
——, ——, miotics and 245
——, diplopia 22, 23
——, double-image 334, 340
——, monocular, in amblyopia ... 324
——, mydriatic 242
——, pilocarpine salivation 620
——, projection 333
——, water-drinking 290
Thiamine, rat visual pathway and ... 144
Threonine 358
Tonometer, international standardization of 767
Torticollis, hyperphoria and ... 592, 599

PAGE

Toxoplasmosis 179
——, congenital 123
——, cortisone and diaminodiphenylsulphone in 490, 492
——, experimental uveal 489
Trabecula... ... ... 50, 134, 137, 244
Trachoma, antibiotics in ...119, 690, 672
——, —— ——: *See also* under individual drugs
——, biomicroscopy of 694
——, Denig's operation in 187
——, histopathology of 696
——, microbiology of 695
——, treatment of 694
Transillumination 49, 757
Trephining, corneo-scleral, cataract after 279
Tromexan, retrolental fibroplasia and... 415
Tryptophane, sanguinarine and ... 202
Tuberculosis, conjunctival 568
Tumour, adenomatous, of conjunctiva... 380
——, amyloid 510
—— of chiasm 289
——, lymphomatous, subconjunctival 750
——, ——, uveal 182
—— of optic nerve 285
——: *See also* Carcinoma; Melanoma
Tyrosine 358

Uvea, carcinoma of 182, 699
——, ectropion 285
——, toxoplasmosis of 489
—— wounds of, foreign body and ... 90
Uveitis after indencleisis 649

Valine 358
Vascularization, corneal 433, 488, et seq.
—— of corneal grafts 3, 6, 10, 13
—— of optic pathway 472
——, oxygen and: *See* Oxygen
——, retinal: *See* Retina
—— and retrolental fibroplasia: *See* Retrolental fibroplasia
Vein, aqueous 270, 745
——, central retinal 473
——, choroidal, choroidal detachment and 572
——, episcleral, glaucoma and ... 500
Venous shunt, glaucoma and 688
Ventilation of contact lenses ... 100, 319
Vessel, episcleral, glaucoma and 129, 500
——, retinal 402
Visual acuity, foreign body extraction and 72, 78, 83, 96, 374
—— —— in amblyopia 321, 324, 339
—— ——, international standards of 765, 767

PAGE

Visual acuity in interstitial keratitis ... 670
—— ——, standardization of measurement of 767
—— —— and surgery in glaucoma ... 646
—— ——, sympathetic ophthalmia and 649
—— ——, latent nystagmus and ... 220
—— pathway of rat, degenerative changes in 144
Vision, stereoscopic, and photo-interpretation 29
——, ——, and refractive errors ... 32
——, ——, and suppression 32
Vitreous, haemorrhage of, foreign body and 87, 92, 93, 97, 648
——, herniation of 178
——, loss of, following keratoplasty ... 14

PAGE

Vitreous, loss of, post-operative 94, 177
——, retrolental fibroplasia and 386 et seq.
Von Graefe's operation 642
Von Recklinghausen's disease, optic nerve in 285

Wagenmann, vascular studies of 513, 520

Xerostomia 624

Zinn-Haller, arterial circle of 473

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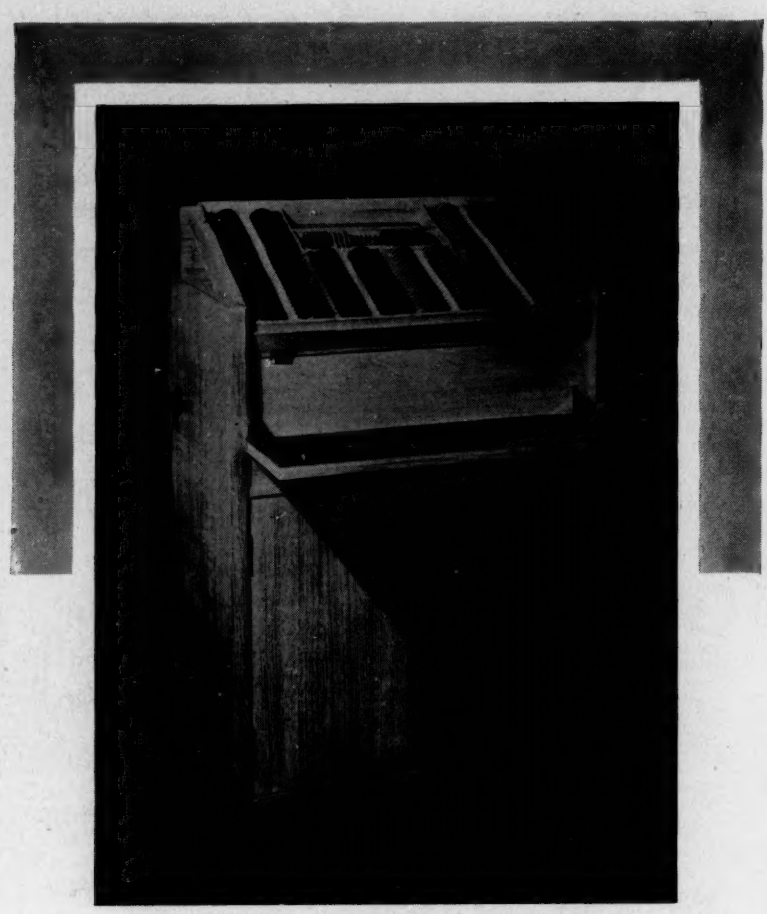

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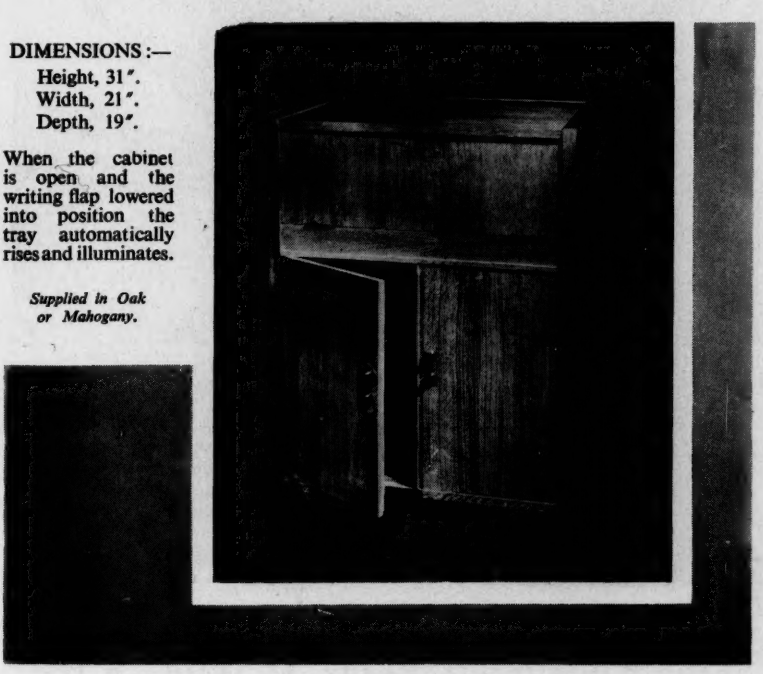

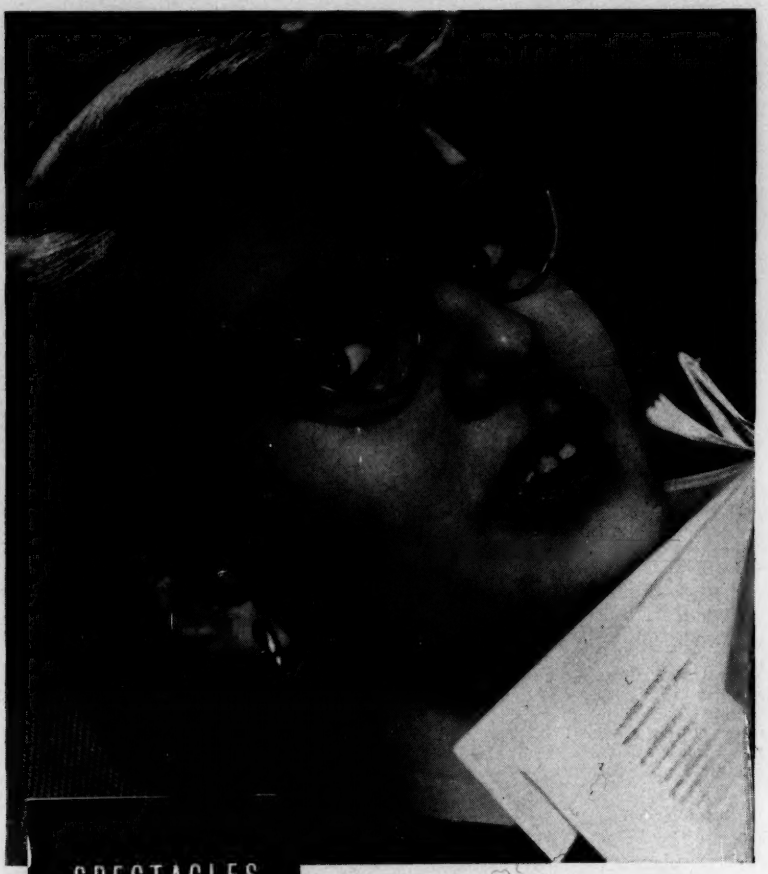

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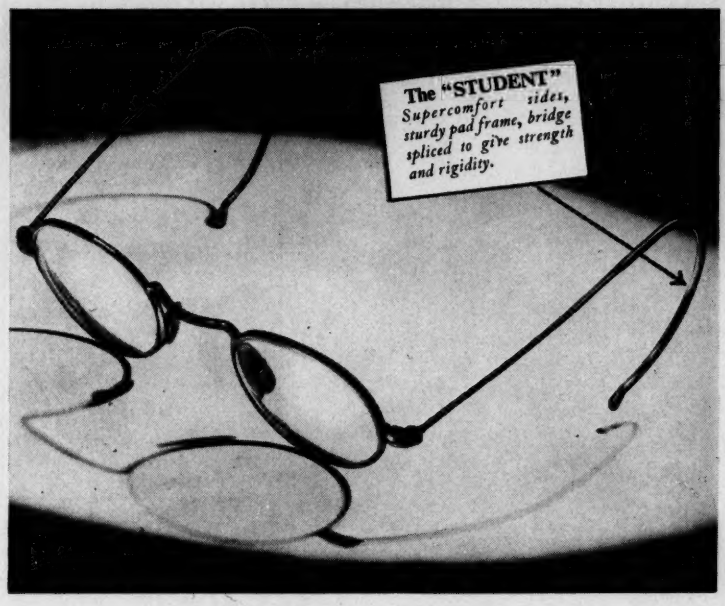

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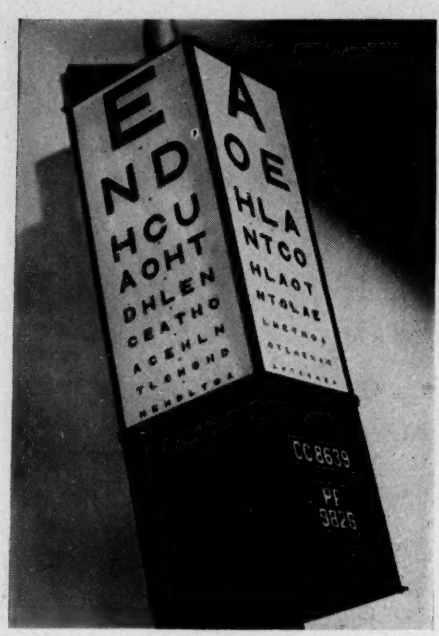

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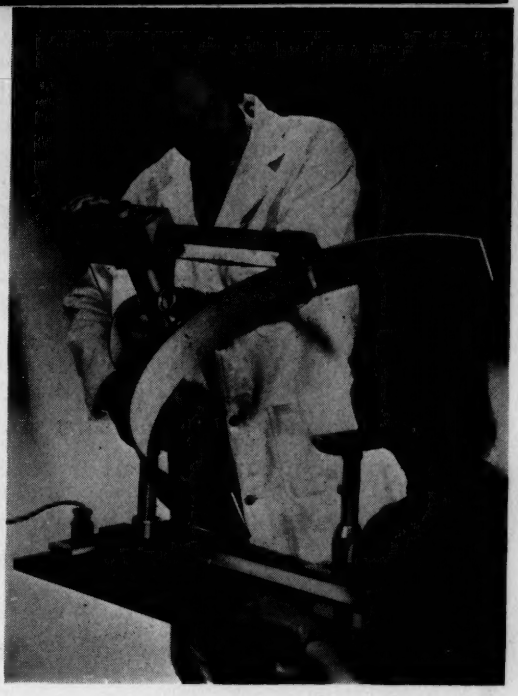

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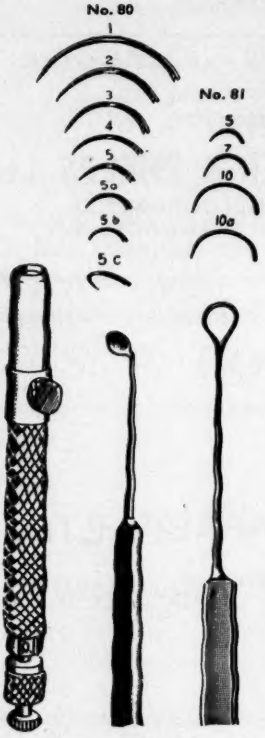

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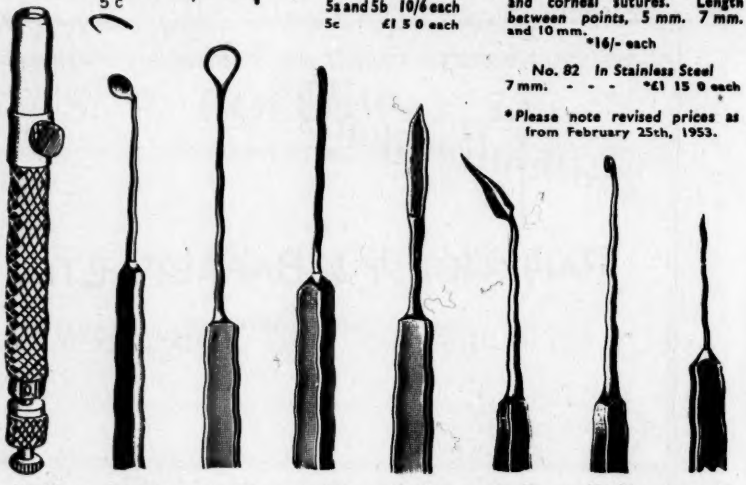

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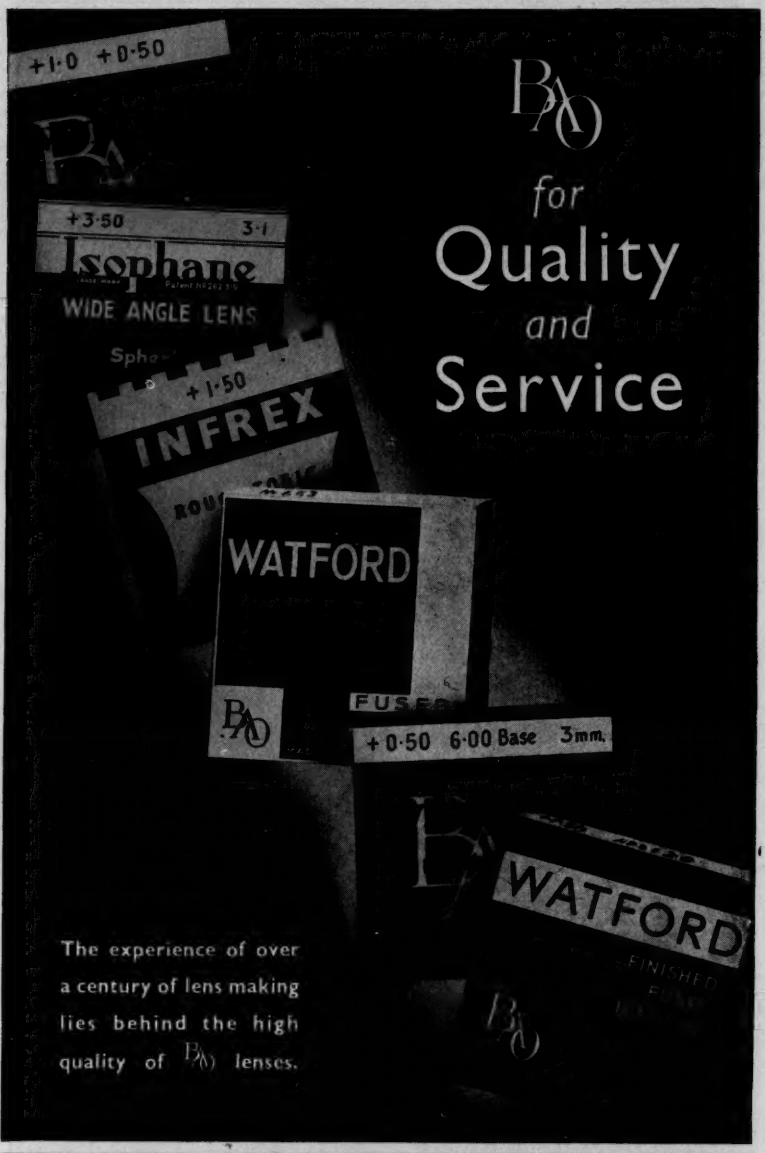

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